Forum

Two-Career Couples:

AGL''s Education and Human Resources Committee sponsored a panel ses-

sion on The Two-Career Couple at the

of East). The response was overwhelming-more than 150 persons crowded into

fessionals. Clearly, we had touched a

1983 AGU Fall Meeting (a report on the

the room, many of them midcareer pro-

nerve. In discussion following the panel

peatedly expressed a desire for models,

presentation, members of the audience re-

guidelines, or policy statements that could

he shown to an employer, especially with reference to flexible work time, slow ca-

reer advancement, and promotion policy.

session will appear in a forthcoming issue

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Eos, Transactions, American Geophysical Union

Particles and Fields-Ionosphere

500 for Consists and Resperatures A THEOPETICAL T-REGION SITES OF ION CONFOSITIONAL AND THE FRANKE VARIATIONS IN RESPONSE TO MACHETOSPHERIC STURM INDUST J. J. Sojka (Center for Atmospheric and Space Sciences, Utah State Lolversity, Logan, Vtah 84322), and R. V. Schunk

itch State lolusestry, Logan, Utah 84322, and

I. V. Sthunk
The response of the polar ionisphere to magnetosphoric
siorn inputs was modeled. During the 'storm', the
spitial extent of the surcrai oval, the intensity of the
precipitating socretal sleator on energy flux, and the planmas convection pattern were varied with rine. The convetton pattern changed from a symmetric twovetton pattern changed from a symmetric twovetton pattern with enhanced plasma flow in the dust escvith a 20 ky reces-tail potential to an asymmetric twocell pattern with enhanced plasma flow in the dust escter min a total cross-tail potential of 90 ky. During
the storm there were significant changes in the ion centive min a total cross-tail potential of 90 ky. During
testature, ion conposition, and solecular/storale ion transitien height. The storation symmetric convection partern produced an ion temperature hat spot at the locative of the dust convection cell owing to increased ionmetric frictional basising. In this hor spot there were
significantly enhanced Not densities, advantage and successive phase, the decay of the enhanced Not density
speed. Ouring the storm calculated ion temperatures also
appeared at high altitudes in the sidnight-duve succest
avair region. These elevated ion temperatures uses a
which provided better thermal coupling to the hot elecstrict ion transition heights. These elevated ion temseveral bions after the storm and phase ended.

J. Gaphys. Ras., A, Papar AA0051

Sign Ion densities and temperatures

Sign Ion densities and temperatures

MINEN'S IORGUMENT: IMPERED ELECTRON DEMSITIES

M. L. Estaer, M. D. Beach, J. E. P. Commerney

I. Latier, F. D. Beach, J. S. P. Commerney

I. Latier, F. D. Beach, J. S. P. Commerney

I. Latier, M. D. Beach, J. S. P. Commerney

I. Latier, M. D. Beach, J. S. P. Commerney

I. Latier, M. D. Beach, J. S. P. Commerney

I. Latier, M. L. Latier, M. L. Latier, J. L. Latier, L. Latier, L. Latier, J. L. Latier, J. L. Latier, J. L. Latier, L. Latier, J. L. Latier, L. Latier

5140 Particle pratipitation
ATEMACE ELECTRON PRECIPITATION PATTERNS AND TIMEAL
ATRON. CHARACTERISTICS BORIER GROMASHITE QUIECCRIC.
L. Gallen (1989/Apl., Laurel, Retpland, 20787) and C.-I.

Vol. 65, No. 6, Pages 41-48

Vol. 65 No. 6 February 7, 1984

Transactions, American Geophysical Union

the upper band chorus whose generation mechanism is got well agreed upon. It is shown that the impulative cherts in the upper band is generated with its wave normal: close to the chilque resonance come. This suggests that the upper band chorus is quasi-electrostatic, and it is furthermore confirmed by the estimated ratio, o hi/fill [is] and [is] (the total electric and magnetin field intensities, o, the light velocity), while, the rising tones in the upper band have indicated a difference such that the closeness of their wave normals to the chilque resonance come is much less distinct. An inten-siva comparison is made between the direction finding results for the upper band and the theoretical mecha-nisms so far proposed in order to elucidate the possi-ble generation mechanism of the upper band chorus. Usagenetosphere, VIP emissions, chorus, direction find-ing).

J. Gaophys. Les., A, Paper A40038

5580 Wave propagation
PROFAGATION OF PLASMA WAVE EMERGY IN THE AUDORAL
B-RECTOR
D. R. Hoorcorett (Centre for Radio Science and
Department of Physicas, University of Western Ontario,
London, Ontario, Canada Réa 387)
The propagation of electrostable plasme wave energy
in the autoral E-ragion has been studied using fluid
theory. Typically a wave travals ab high speed nearly
namalial is the magnetic field, surcept possibly for a
small height interval where it is reflected upwards!
throughout, the direction of the propagation equtor
remains virtually modulaged, and nearly nergandicals!
to the magnetic field. If k saless an angle of nore
than 0.23° with the anguetic field the wave passes
through the S-region without reflection. Kinks in the
sugnatic field line (due to survoral ourrants) way lesd
to trapping of waves in layers less than 1 is thick
Secondary irregularities may be limited in both
horizontal and variousl exists because of their mation
relative to the primary waves on which they depone for
growth. The propagation within the spaining the
irregularities have also been considered in the 15gh
of this work. Saveral objected waters of radio
survers may have explainations in terms of these
J. Gaophys. Res., A, A40512

glas of the low-latitude part are generally greater than between the bard and soft regions is called the transition boundary. It is found that during quiet times the boundary. It is found that during quiet times the boundary. It is found that during quiet times the boundary is at particularly high generalization polescand tors and at about \$2\cdot to \$2\cdot in the sidelition practipitation polescand tors and at about \$2\cdot to \$2\cdot in the sidelition for a specified any of 10 honorhory. The control of the state of the serving sectors and at about \$2\cdot to \$2\cdo to \$2\cdot to \$2\cdot to \$2\cdot to \$2\cdot to \$2\cdot to \$2\cd

Laboratory, Washington, D.G.)
A nonlocal theory of the current convective instability in the presence of a transverse velocity shear is developed. It is found that the velocity shear is devaloped. It is found that the velocity shear is bilizes the short wavelength modes and preferentially excites a long wavelength mode. Application to castweet structure in the high latitude auroral P layer plasma enhancements is discussed. (shear, currents, high latitude) J. Geophys. Bes., A. Paper 4A0052

J. Gaophya. Res., A. Paper &A0052

3563 Plasma motion, convention, or circulation
THE EFFECTS OF INTERPLANSTARY MAGNETIC FIELD GRIENTATION OF DAYSIDE HIGH LATTINGS INCOSPRENIC CONVECTION
B. A. Heelis (Conter for Space Sei. Univ. of Turns
at Dalias, Richardson, TX 75083)

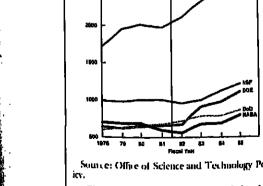
The Atmosphere Employer—C data hase of morthern
benisphere incompheric convection signatures at high
initiation is manifed during times when the interplanetary magnetic field orientation is relatively
stable, It is found that when the HPY has its
expected garden hose orientation, the contar of a
respective for the sign of R. Followard of the
interpretation of the sign of R. Followard of this
respective of the sign of R. Followard of this
respective of the sign of R. Followard of this
ristincture of the sign of R. Followard of this
is directed toward dawn or duck depending on whicher
is in paintive or sagative, respectively. The
obsurved fiber geometry can be explained in terms of a
supercaphera solar wind intersection in which merging
is fevered in sither the primon morther hemisphere
or the pre-moon southern hemisphere
or the pre-moon southern hemisphere
content sector attracture that is toward or every.

Tempercular actor attracture that is toward or every.

Tempercular actor attracture that is toward or every.

pre-motor structure of a second structure of Automotor of

Applied Research Pagel Year Source: Office of Science and Technology Pol-Fig. 1. Nondefense federal R&D.



Yews

Congress earlier this month.

partments and agencies.

A Mars mission, a new research thrust on

the continental lithosphere, increased efforts

in digital cartography, and construction of a

Reagan budget. Research and development

support would grow 14% to \$53 billion (\$51.8 billion would go to conduct of R&D, while \$1.3 billion would be allocated to R&D

facilities). With a projected inflation rate of

about 4%, this increase would provide real

growth of 10% over fiscal 1984 levels. The

largest increase for R&D, 22%, would sup-

port defense modernization. Figure 1 com-

pares nondefense federal R&D obligations

since 1978 in constant 1983 dollars, while Ta-

ble I compares conduct of R&D by major de-

Basic research would get the next largest

hike, up 10% to \$7.9 billion, or about 6%

growth above projected inflation. Agencies

primarily supporting basic research in physi-cal sciences and engineering are stated for

ly supporting life and other sciences would

for the five agencies with the largest basic

R&D budgets.

Of the four nondefense agencies most in-

volved in geophysical research, the National

Science Foundation fared best with a 12.4%

ministration is slated for almost a 4% in-

crease. The U.S. Geological Survey took a

hike; the National Aeronautics and Space Ad-

slight dip (down 3.8%) in the budget request.

Administration's support would shank 9.5%.

Congress, with an eye on the calendar and

but the National Oceanic and Atmospheric

the November elections, has already begun-

hearings in this issue). Eas will track the bud-

Note: Increases and decreases listed in the

following analysis compare the differences

between fiscal 1984 and fiscal 1985, and do

not reflect natural changes in the funding

work on the budget (see the list of budget

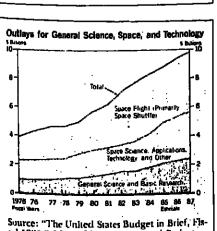
get as it moves through Congress.

Federal R&D Obligations (Nondelense) in Constant 1983 Dollars

better than a 14% boost, while those primari-

get a 5.2% increase. Figure 2 compares basic

research obligations in constant 1983 dollars



ral 1985," Office of Management and Budget.

Geophysics and Overall Science Strong in FY 1985 Budget profile when a program phases in, matures and peaks, and then phases out. Numbers may not total because of rounding.

NSF Budget Up 12.4%

Very Long Baseline Array radio telescope top the list of highlights for geophysics-related research in the proposed fistal 1985 federal budget that President Ronald Reagan sent to The budget request for the National Science Foundation is \$1,501.79 million: Science in general fared well in this fourth

• \$1,308.2 million for research and related •\$115.08 million for the U.S. Antarcic Pro-

• \$75.7 million for science and engineering education • \$2.8 million for special foreign currency

Proposed are funds for

• construction of the Very Long Baseline Array (VLBA) radio telescope • an expansion of ellorts begun in fiscal 1984 to address researchers' needs for advanced computer systems initiation of centers for cross-disciplinary research in engineering

In addition, the budget request nearly donbles the money allocated for the Presidential Young Investigator Research Awards, which were injusted in Iscal 1984. In Iscal 1985, NSF plans to continue support for the 200 scientists selected this year and to support an additional 200. About half of the awards will

be made to engineering faculty. The following percentage increases and dollar requests are slated for the budgets of the various directorates that involve research and related activities:

• Engineering, 21.8% to \$147.1 million Mathematical and Physical Sciences, 16.15. to \$416.7 million

 Biological, Behavioral, and Social Sciences. 12.7% to \$253.1 million · Scientific, Lechnological, and International Affairs, 44.9% to \$46.9 million

· Astronomical, Atmospheric, Farth, and Ocean Sciences (AAFO), 13.2% to \$373.5

Within AAEO, the following percentage increases and dollar amounts are proposed. Astronomical Sciences, 19.5% to \$93.4 mil-

• Earth Sciences, 17.1% to \$48.6 million Ocean Sciences, 9.9% to \$124.9 million Atmospheric Sciences, 10.3% to 98.6 mil-

• Arctic Research Program, 82% to \$8.0 mil-

Astronomical and Atmospheric Sciences

Slightly more than one-third of the \$93.4 million proposed for the astronomical sciences division of AAEO is slated to support the National Radio Astronomy Observatory (\$33.4 million, up 62.1%). Construction of the VLBA radio telescope will be the centerpiece of this program, as recommended by the National Research Council's Astronomy Survey Committee. Support for the Kitt Peak National Observatory, the Cerro Tololo Inter-American Observatory, and the National Solar Observatory totals \$24.8 million (up 4.9%). The two other components of the astronomical sciences division are slated for smaller increases: astronomy project support is slated for \$28.9 million (an increase of 4.3%), while the National Astronomy and Ionosphere Center would get \$0.3 million (up 1.6%).

For astronomy project support, the biggest increases are proposed for extragalactic as-

Department or agency

Administration

TABLE 1. Research and Development by Major Departments and Agencies in Millions of

1983

1,062

360

374

327

241

177

lti-l

207

of Engineers, and the Federal Emergency Management Agency.

Obligațions

tronomy (up 28,5% to \$7.5 million) and for galactic astronomy (up 17.6% to \$5.3 million). Increases also proposed for fiscal 1985 are for solar system astronomy (up 4.6% to \$1.3 million) and for stars and stellar evolution tup 3% to \$6.5 million). Funds to support research on the electromagnetic spectrum management would remain the same as in listal-1984 (\$100,000), while astronomical instrumentation and development would take a

In the atmospheric sciences division, the largest increase is slated for the National Center for Atmospheric Research (NCAR) tup 14.8% to \$45.9 million). Most of this increase results from the proposal for the installation of an advanced vector computer at the Boulder-based center. (Scientific computing would get a 42.2% boost to \$13.4 million.) Other increases within NCAR would go to atmospheric analysis and prediction (up) 4.5% to \$3.6 million), to aumospheric chemistry and aeronomy (up 4.5% to \$2.9 million). to convective storms (up 1% to \$2.4 million). and to advanced study programs (up 4.5% to \$1.5 million). Support for administration and support services is slated to increase 4.5% to \$4.9 million and contractor fees are expected to rise 4.6G to \$941,000. Physical plant operation and maintenance would get \$5.3 million, a 42.3% like. Slated for slight decreases at NCAR are funds for the High Altitude Observatory (down 2.1% to \$3.5 million) and atmospheric technology (down 2.3% to \$7.5)

Annospheric sciences project support, the largest component of the atmospheric sciences division, would get \$48.5 million, an increase of 6.6%. Proposed increases for individual projects hover around 8%; aeronomy is budgeted for \$6.6 million, atmospheric chemistry for \$7.3 million, climate dynamics for \$7.8 million, experimental meteorology for \$5.6 million, meteorology for \$9.1 million, and solar terrestrial research for \$7.7. million. The Global Atmospheric Research. Program (GARP) continues to phase down Gedecrease of 6 3% to \$4.5 millions with data analysis well underway

The Upper Atmospheric Research Licitities program, the smallest component of the division, would get a 7.9% morease to \$4.1 mil-

Earth and Ocean Sciences

Most of the proposed increase for the earth sciences division goes to the continental lithosphere program. Recommended as a cluet emphasis by the National Research Council's Board on Earth Sciences in their report, Opportunities for Research in the Geological Sciences. and by the National Academy of Science's Research Briefing Panel on the Solid Earth Sciences (Em. December 20, 1983, p. 985), this program would get \$7.7 million in fiscal 1985, up from \$3.7 million in Iscal 1984.

After the continental lithosphere program. the largest increase goes to instrumentation

and facilities (up 20% to \$6 million). All of the other programs within the division are also slated for increased funding in fiscal 1985; stratigraphy and paleontology, up 5.47 to \$3.9 million; surficial processes, up 7.4% to \$2.9 million; crustal structure and tectonics, up 5 3% to \$4.0 million; petrogen sis and mineral resources, up 5.1% to \$4.1 million: volcanology and mantle geochemistry, up 8.3% to \$3.9 million; and experimental and theoretical geothemistry, up 7% to \$6.1 million. The seismology program and the experimental and theoretical geophysics program each would rise 6.4% to \$5.0 mil-

In the ocean sciences division, funding for the Ocean Drilling Program is slated to in-crease 4.97 to \$27.6 million. Although costs for the program are expected to rise from

1984 1985 1983 1984

Actual Estimate Estimate Actual Estimate Estimate

22,025 27,636 33,852 21,057 25,310 31,053

4,491 4,814 4,885 4,771 4,853 4,744

4,348 4,859 4,950 5,092 4,529 4,869

(3.788) (4.240) (4.342) (3.538) (3.968) (4.267)

6615

832

312

235

154

220

340

38,431 45,279 51,776 36,560 42,686 48,712

3.257 3.344 2.538

898

272

198

168

396

1.239 1.408

87.2

519

415

357

250

225

223

393

Coutlass

3,462

1,136

145

403

349

252

208

174

211

399

8.314

277

297

208

416

167

15.2% cut to \$8.2 million.

People telt that alternatives are feasible. and that the present lack of policies is largely due to ignorance, by both employ-ers and employees, of practical solutions. "Surely, with so many women entering the work force, once corporations or agencies must have developed guidelines!" It would be inappropriate for AGU to propose any such guidelines. However, we can collect and publicize information that might be useful. Below is a short list of relevant publications, kindly provided by Jennie Earley of the School of Industrial and Lahor Relations at Cornell, Members who know of other publications or policy statements by employers are urged to share this information via the AGU Committee on Education and Human Re-

> The Woman in Management, Career and Lanuty Jones, Jennie Farley, H.R. Press, Cornell University, 6thaca, N. V., 142 pp., 1983.

areas Outcomes in a Matched Sample of Menand Women Ph D. v. An Analytical Report, N t. Abern and J. T. Scott, National Acade my Press, Washington, D. C. (1981) diverse and Couples: An Academic Question, 1. Hoffmann and G. DeSole (Eds.), Modern Tanguage Association, New York, 1976. inspirations and Law Carer Landles Direction Tin the Latine, Catalysi Career and Laundy Center, New York, 1981

Climbing the Academic Lidder Theorem Women Scientists in Academy, NRC Commission on Human Resources, National Academy of Sciences, Washington, D. C., 1979.

> Member, Act I ducation. and Human Resources Committee

\$29.5 million in tescal 1984 to \$37.6 million in Iscal 1985, the contribution from other nations is expected to jump from \$1.2 million to \$10 million. Drilling is expected to commence at the start of fiscal 1985 (Em. January 31, 1984, p. 33). Ocean science research support, the second component of the ocean sciences division, would get an 41.5% hike to \$60.9 million. This support funds research in physical oceanography (\$17.2 million, up 113), marine chemistry (\$13.4 million, up 11.77), submarine geology and geophysics (\$16.1 million, up 117), and biological oceanography (\$14.2 million, up 12.7%). The third companent of ocean sciences, called oceanographic facilities and support, is slated for an 11.1% increase to \$36.4 million.

Polar Programs

AAEO's arctic research division would receive \$8.0 million for fiscal 1985, an increase of more than 857 over the current fiscal year. Biological sciences research is slated for the largest dollar increase, up \$229,000 to \$2.2 million, followed closely by authospheric sciences (up \$120,000 to \$1.1 million) and earth sciences (also up \$120,000 to \$1.2 million). Glaciology research has been slated for a 7.1% increase to \$2.1 million, while the funding for oceanography research in the remains unchanged at \$1.2 million.

Money requested for the U.S. Antarctic Program, which is a separate activity and not part of AAEO, totals \$115.1 million, an increase of \$12.6 million over fiscal 1984. Autarctic research (up 7.4% to \$14.0 million) includes funding for atmospheric sciences (\$2.2) million, up 4 8%), biological sciences (52.5 $_{\odot}$ million, down 3.9%), earth sciences (\$1.8 million, up 5.9%), glaciology (\$1.9 million, up 18.8%), oceanography (\$1.9 million, up 19,2%), and information and advisory services (\$700,000, up 7.7%). Operations support for the U.S. Antarctic Program will increase

Engineering

Within the Directorate for Engineering, the Division of Civil and Environmental Engineering is slated to receive \$39.8 million, a . 17.7% boost. Within the division, requested is \$4.6 million (up 17.9%) for georechnical engineering, \$4.7 million (up 34.3%) for structural mechanics, \$4.3 million (up 23.0%) for hydraulies, hydrology, and water resources en-

News (cont. on p. 50)

49

The pattern of pater-region, electron pracipitation for a geomogentically quiet period (Loo, dwith under the positive ENP S, tendition) is examined on the basis of materiasms from the Defense Haborstonical Sanitative Program 77, 17, and 78 materials of Sanitatives Procipitation dering quiet times consists of hec distinct types that differ from these found in active Sines. The high-leating part of the pricipitation region has an energy electron complete layer than 500 of oth being processes. The Average organisation 500 of oth being premained. The Average organisation seems of the pricipitation for the pricipitation of the pricipita

February 7, 1984

J. Geophys. Les., A, Paper 446058

Source: Office of Science and Technology Pol-Fig. 2. Basic research in five federal agencies.

Defense-military functions Health and Human Services National Institutes of Health* National Aeronnatics and Space National Science Foundation Agriculture Fransportation Commerce Environmental Protection Agency Agency for International Development Veterans Administration Nuclear Regulatory Commissio All other** Source: Office of Management and Burdget, Numbers may not total because of councing Total *Figures in parentheses are part of the corresponding amount for Health and Human Services. rigures in parentness are parent of Education, Justice, Labor. Housing and Urban Development, and Treasury, the Tennessee Valley Authority, the Smithsonian Institution, the U.S. Army Corps

News (cont. from p. 49) gineering, \$3.8 million (up 15.2%) for ironmental and water quality engineering, \$2.4 million tup 20%) for construction engineering and building research, and almost \$20 million (up 13.1%) for earthquake haz-

NASA: Mars and Space Station

ard outigation

Although the proposed fiscal 1985 hidget for the National Agronautics and Space Administration (NASA), totaling \$7491.1 milhon, shows just under a 4% increase over fiscal 1984, the budget includes three major new untratives. Most loudly jouted of these is a termanently manned space station, for which \$150 million is requested (see story this issue).

Another minative, a Mars mission called the Mary Geoscience/Climatology Orbiter (MGC), would be "the first of a new series of relatively low-cost planetary observers deagned to investigate specific questions in planetary wiemer," according to NASA. Administrator James M. Beggs, MGCO was part of the core program for planetary explo-ration recommended by the Solar System Exploration Commutee of the NASA Advisor Council (Ecs. May 24, 1983, p. 386, and Febmary 15, 1983, p. 65). The funds requested in the local 1985 budget (\$16 million—within the planetary exploration category) would begin the design and development of the orbitor and its instruments, leading to a 1990 -Lionely MGCO will measure the geologic and climatic evolution of Mars.

Development of the Upper Armospheric Research Satellite d'ARSi will begin in fiscal 1985. UARS will place into earth orbit instru ments that will enable a comprehensive, global measurement of the stratosphere to be

Space Flight

Largest of the four NASA budget categothey is Space Flight, Control, and Data Commoneatons, which with proposed funding rotating \$ 0000 Cublion, represents almost half of the agency budget. This caregory inwholes space shallk production, querations, and macking and data arquismon. Next largest is test arch and development (\$2400.1 milfrom followed by research and program management (\$1.01 0 million) and construction of tachtres (\$160 et million)

Space Flight, Control, and Data Communications to a new category representing an internal reorganization at the agency. Plans for fiscal 1985 (include 11 space shuttle famiches, the second and third spacelab missions, launch of the second and third. I acking and Data Relay Satellines (1DRSS), completion of the space shuttle free with the expected delivery of the fourth orbiter (Atlantis) in December 1984, and communed bardware development for the U.S.-Irahan, Tethered Satellite System. Specifically, funding for space shuttle production and operational capability disps 11 17 to \$1 055.6 million, while space transportation operations declines 78% to \$13,940 million. Support for space tracking and data acquisition grows 18 Pr. to \$795.7 million. Desput the extensive plans, total funding for this category shows a \$ 6% decrease from fiscal 1984, reflecting a maturation of the shut-

Research and Development

Six activities fall under NASA's research and development category (1) The largest is space seitner and applications, allocated with \$1371.5 million, an mercase of 20,0% (2) The new space station would get \$150 million in heat 1985, while 13) space transportation cap balts development is budgeted for \$.00 Coulliers duraking 16 3%, (4) Technology authration would be familed at \$9.5 milbon (up \$500) 000), (5) actonautics and space technology \$192.1 million top \$53.1 million or 12 P/O, and do nacking and data acquisition \$15 Condition up by \$1 Condition.

The space source and applications actions, in turn, is disided into four programs. The hast, physics and autonomy, is hudgered for \$677.2 million, are mercase of 19.3% over his cal 1981. The largest increases within this program could go to mission operations and data and say (up 60 2) to \$109.1 million), to Garana Ray Observatory development tup to be to \$120 2 collion), and to shuttle speedab perford development and mission in magazinent con 30377 to \$1054 million. Smaller increases are allocated to the subor-Lost program cup 12.25 to \$58.7 million), to Explorer development top 6.6% to \$51.9 milhour and to research and analysis tup 3.1% to \$36.9 millions. Largerest for a slight decrease. 18 Spike telen ope development (down Stantiffic in \$1950 million)

Planetary Exploration

Planetally exploration, the second program within space science and applications, is hadgered for a 32% increase to \$286.0 million. Most of the increase is attributable to the addirect of \$63.5 million (up 219%) to support

the Venus Radar Mapper mission, bringing the total for fiscal 1985 to \$92.5 million. The newly proposed Mars Geoscience/Climatology Orbiter is budgeted for \$16.0 million. Hefty increases also are slated for the International Solar Polar Mission (up 50% to \$9 million) and to mission operations and data analysis (up 35.5% to \$58.8 million). Because much of the foundation work is completed for the development of Galileo, a decrease of 29.49 to \$56.1 million is proposed. Research and analysis is slated for an 8.4% cut to \$54.5 million.

Space applications, the third component of the space science and applications subactivity, would get an overall 18.2% loost to \$344.1 million. This program is divided into solid earth observations (down 15,6% to \$63.6 miltion), environmental observations (up 36.23 to \$220.7 million), materials processing in space (down 2.5% to \$23.0 million), commuolications (down 2.4% to \$20.6 million), and information systems (up 82% to \$16.2 mil-

Within solid earth observations, funding for the shuttle/spacelab payloads would grow 13.1% to \$18.1 million, while goodynamics and research analysis would each increase. 6.8% to \$29.9 million and \$15.6 million, respectively. There is no money in the NASA dget for Landsat-1 (which, as the in-orbit Landsat-D, is handled by the National Oceanand Atmospheric Administration).

Within environmental observations, support for the upper atmosphere research satel-lite mission would more than triple to \$60.7 million. Extended mission operations is budgeted for \$29.5 million (up 7.75), upper atmosphere research and analysis would get \$31.0 million (up 8.8%), atmospheric dynamics and radiation research and analysis would get \$28.5 million (up 3.6%), oceanic processes research and analysis would get \$19.4 million (up 6.6%), and space physics research and analysis would receive \$16.7 million (unchanged from fiscal 1984). Funding for the shuttle/spacelab payload development would grow 2.6% to \$7.8 million. Additions to the program include the scatterometer (\$15 milhom), the rethered satellite payloads (\$3.0 million), and interdisciplinary research and andvsis (\$1 million). Familing for the earth radiation budget experiment (ERBE) nearly halves to \$8.1 million. The operational satellite improvenent program is chimicated in the fiscal 1985 budget request.

The life sciences program, the fourth component of the space science and applica-tions activity, is budgeted for a 9.1% increase to Still nullion

USGS Underscores Mapping Funding for the U.S. Geological Survey (USGS) proposed for fiscal 1985 totals \$391.8. million (a decrease of 3.8% from fiscal 1984) (See Table 2 for a breakdown of major categories). Digital carography, part of the na-tional mapping program, has been allocated a \$3.3 million increase. The additional funds will initiate digitizing of hydrography and transportation data for the country at a scale of 1:100,000. This will aid the Bureau of Census prepare for the 1990 census.

Geologic and Mineral Resources

Within the geologic hazards subactivity within Geologic and Mineral Resources, none of the programs are budgeted increases. The earthquake hazards reduction program would receive \$33.1 million (down 6.2%), resulting in a 10% reduction in earthquake monitoring networks and approximately a 15% reduction in quake prediction networks. I en projects in earthquake prediction studies and five field projects on earthquake potential in California would be discontinued. The volcanic hazards program would get \$9.5 million (down 12.8%), and the ground tailure and construction hazards program would get \$2.1 million (same as fiscal 1984).

The land resource surveys subactivity, with a total proposed budget of \$20.0 million for fiscal 1985, includes the geomagnetism program (down 9.1% to \$2 million), the climate changes program (halved to \$0.5 million), and the geologic framework program (up 24.1% to \$17.5 million). These cuis would mean delaying final magnetic chart production for about 1 year, eliminating two research projects to develop new mathematical models, and terminating investigations assessing the link between climate change and variations in the earth's magnetic field. The geologic framework program incorporates the reactor hazards program that had previ-ously been included in the geologic hazards subactivity and includes a \$1 million initiative for cooperative federal/state geologic and

geophysical mapping.
The mineral resource surveys subactivity shows a \$1.4 million increase to \$46.3 million. Slated for the largest percentage increase is 4.1% to \$12.8 million. Also allocated funding growth are the Alaska program (up 1.1% to \$9.5 million), the coterminous states program (up 3.5% to \$5.9 million), the wilderness program (up 2.4% to \$8.5 million), and the strategic and critical minerals program (up 3.3%) to \$9.5 million). Increases for the coterminous states and the critical minerals programs were for pay cost increases.

Energy geologic surveys would show a net decline of 13.6% to \$26.0 million. Some of the money from the coal investigations program and the onshore oil and gas investigations program has been moved into a new program called "evolution of sedimentary ba sins," which has been budgeted for \$4.7 million in the fiscal 1985 budget request. Coal investigations would get \$7.4 million and onshore oil and gas investigations would receive \$4.7 million. Oil shale investigations would grow 20% to \$600,000. Decreases are proposed for uranium/thorium investigations (down 19.5% to \$3.3 million) and for the geothermal program (down 25% to \$5.4 million), suspending studies of shallower, hightemperature hydrothermal resources. The

world energy program has been eliminated. The fifth subactivity, offshore geologic surveys, would get a 2.7% increase to \$19.1 million. A significant part of the work would focus on assessing the mineral and energy resources in the 200-mile Exclusive Economic

Water Resources

Within the National Water Data System Federal Program subactivity, a \$900,000 increase has been allocated to the data collection and analysis program, bringing its bud-get up to \$16.9 million in the next fiscal year.

Other increases within the subactivity have been apportioned to the improved instrumentation program (up 5% to \$2.1 million). the water resources assessment program (up 7.7% to \$1.4 million), the toxic substances program (formerly called the toxic wastegroundwater contamination program) (up 4.7% to \$8.9 million), the acid rain program (up 6.7% to \$3.2 million), the environmental affairs program (up 14.3% to \$800,000), and the confdination of national water data activities program (up 11.1% to \$1.0 million to cover pay cost increases).

Decreases in the subactivity are slated for the national water data exchange program (down 23.1% to \$1.0 million) (resulting in a 10% reduction in capability to respond to in quiries), the regional aquifer systems analysis program (down 3.3% to \$14.6 million), the core program of hydrology research (an 8.5% drop to S6.5 million), and supporting services (a two-thirds cut to \$1.1 million). The budge this year keeps the water resources scientific information center at \$900,000 and again allocates no money to the flood hazard analysis

Within the National Water Data System: Federal/State Cooperative Program, the data collection and analysis program would get a 1.7% boost to \$42.7 million to cover pay cost

TABLE 2. USGS Budget, in Millions of Dollars

Activity	FY 1983	FY 1984	FY 1985 Proposal	Change, 1984 to 1985, in Percent
Geologic and Mineral Resource Surveys		·		
vecologic hazards	51.6	53.1		
Land resource surveys	17.5	51.4 17.0	44.8	– 12.X
Mineral resource surveys	11.1	17.2	20.0	+ [6.3
hargy geologic surveys	31.2	44.9	46.3	+3.1
Ollding gerhigh surveys	15.5	30.1	26.0	-13.6
Subtota)	159.8	18.6	19.1	+2.7
Water Resources Investigations	199.0	162.2	156.2	3.7
Satorial water data system: federal program				
National water data system: federal/ state cooperative program	55.1	60.3	5N.5	-3.0
Fuergs hydrology	45.8	49.1	50.1	
Water Resources Research Institute	15.1	11.9	7.9	+2.0
Subtotal	Ð	6.4	o o	-35.6
	1 ! 6.0	127.6	116.5	-100.0
National Mapping Program Facilities	90.7	90.1	90.4*	-8.7 +0.5
	9.0	10.4	13.3	
General administration	14.9	15.5		+ 27.9
Total, USGS			15.4	-0.8
Source: USGS, Numbers may not total beg • Includes \$11.3 million for diabal contents	390.5	405.9	391.8	- 3.8

Budget Hearings

The tentative schedule for congression: hearings on the Reagan budget request for fiscal 1985 is listed below. Dates and times should be verified with the committee or subcommittee holding the hearing; all offices on Capitol Hill may be reached by telephoning 202-224-3121.

February 22: National Science Founda lion (NSF), by the Science, Technology, and Space Subcommittee of the Senate Commerce, Science, and Transportation Committee, Senate Russell Office Building, Room SR-253, 9:30 A.M.

February 22: National Aeronautics and Space Administration (NASA) (space ransportation systems), by the Space Science and Applications Subcommittee of the House Science and Technology Comnittee. Rayburn House Office Building,

February 23: U.S. Geological Survey, by the Interior and Related Agencies Sub committee of the House Appropriations Committee, Rayburn House Office Buildng, Room B308, 10 A.M. February 23: NSF, by the Science,

Fechnology, and Space Subcommittee of he Senate Commerce, Science, and Fransportation Committee, Senate Russel Office Building, Room SR-253, 9 A.M. February 28: NASA, by the Science,

Technology, and Space Subcommittee of the Senate Commerce, Science, and Transportation Committee, Senate Russel Office Building, Room SR-253, 9:30 A.M. February 28: NSF, by the Science Research and Technology Subcommittee of

the House Science and Technology Com-

mittee. Rayburn House Office Building. Room 2318, 2 P.M. February 29: NASA (space tracking and data systems and technology utilization), by the Space Science and Applications Subcommittee of the House Science and Technology Subcommittee: Rayburn House Office Building, Room 2325, 1

February 29: NSF by the Science Research and Technology Subcommittee of the House Science and Technology Committee. Rayburn House Office Building. Room 2325, 9:30 A.M.

March 1: NASA, by the Science. Lech Bology, and Space Subcommittee of the Senate Commerce, Science, and Transpor tation Committee, Senate Russell Office Building, Room SR-253, 9 A.M.

March 1: NASA (construction of facilities and research and program management), by the Space Science and Applications Subcommittee of the House Science and Technology Committee, Rayburn House Office Building, Room 2325, 10

March 8: NASA, by the Science, Technology, and Space Subcommittee of the Senate Commerce, Science, and Transportation Committee. Senate Russell Office Building, Room SR-253, 9 A.M.

March 13: Markup of the authorization for the NASA budget by the Space Science and Applications Subcommittee of the House Science and Technology Committee. Rayburn House Office Building. Room 2325, 9:30 A.M.

March 29: NASA, by the HUD-Indeendent Agencies Subcommittee of the Senate Appropriations Committee, Senate Dirkson Building, Room SD-124, 10 A.M.*---BTR*

increases, while funding for the water use program would drop by nearly 25% to \$3.0 million. The coal hydrology program has been allocated \$4.4 million, a 37.5% increase.

In the energy hydrology subactivity, the nuclear energy hydrology program would re-ceive \$7.6 million (up 5.6%) and the oil shale ydrology program would receive the same funding as in fiscal 1984, \$300,000. The coal hydrology program that had been contained in this subactivity has been consolidated with the coal hydrology program in the federal/ state cooperative program.

The Water Resources Research Institute

has been eliminated from the Water Resources Investigations activity.

NOAA Budget Declines

The total budget appropriation request for the National Oceanic and Atmospheric Ad-ministration (NOAA) is \$899.3 million, a decrease of \$94.2 million from the fiscal 1984 appropriation of \$993.5 million. The budget includes proposals for users of NOAA's services to pick up a greater share of the costs. for the continued funding of the Next Generation Weather Radar (NEXRAD) and the modernization of the National Weather Service, and for the procurement and operation of two geostationary and one polar-orbiting meteorological satellites. The budget request consists of a program requirement of \$1,017.8 million, which would be offset by various transfers, adjustments, and revenues from service charges that total \$118.5 million.
The lion's share of NOAA's funding would

go to Operations, Research, and Facilities

(ORF), targeted to receive:\$921.5 million,

\$93.3 million less than appropriated for fiscal 1984. Many of the cuts proposed for ORI had been requested for fiscal 1984, bin were subsequently restored by Congress, ORF is divided into five activities; ocean and coastal programs, marine fishery resource programs, atmospheric programs, satellite and environ-

mental data and information services, and

Atmospheres and Satellites

Atmospheric Programs

program support.

Better than one-third of ORF's bunds would go to the atmospheric programs activity. The budget request of \$358.2 million (down 2.1% from fiscal 1984) is split between public warning and to ecasting services. (\$311.0 million, virtually unchanged from FV 1984) and atmospheric and hydrologic research (\$47.2 million, down \$6.1 million). Among the proposals included in the decreases for public warning and forecasting services are closing the southern region headquarters, climinating regional hydrologists offices, reducing shall at eight weather service forecast offices, and reducing night staffs at those offices. The decreases slated for atmospheric and hydrologic research include reducing funding to the Prototype Regional Observations and Forecast Service (PROFS) (Ens. April 13, 1982, p. 233), to National -Weather Service research and development. to acid rain research, and the climination of research and some services at the Solar Favironmental Laboratory.

Satellites and Environmental Data and In-

The second largest of ORFs live activities, Satellite and Environmental Data and Infor mation Services, is budgeted for \$271.7 mil-

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Cover. Water flow paths in geothermal

energy reservoirs are often dominated by

fractures, whether natural or hydraulically

induced, as is the case in the Los Alamos

Hot Dry Rock project. The extracted wa-

ter must be disposed of after its energy is

removed for beneficial purposes, and of-

cooled water back into the same fractures

from which it was extracted. In that case

the objective is to avoid too early an arriv-

al of the cold recharge at the extraction

well and at the same time avoid the ex-

pense of piping the recharge great dis-

tances away. An attractive alternative in

tures is to attain adequate separation by

using gravity and the density difference

between the cold recharge and hot efflu-

ent. For a given geometry the effective-

ness of gravity separation improves as the ratio of the Grashof and Reynolds num-

bers increases: Increasing the water densi-

ty difference or the fracture permeability

The apparatus in the photos represents

a vertical fracture viewed from the side.

hot water outlet; the tube below is used

The upper clear plastic tube provides the

for recharge; and the recirculated water is

cooled in a peripheral heat exchanger, not

shown. The water is confined between a

transparent, Plexiglas sheet (in from) and

metal framework attached to the Plexiglas

sheet allows accurate and uniform setting

of the distance between the confining sur-

faces, thus controlling the fracture perme-

Streamlines are observed through the

use of two methods. In the first method,

using the technique of D. J. Baker (Journal of Fluid Mechanics, 26, 573-575, 1966),

fine platinum wires were immersed in the

water (which is actually a dilute solution of

an electrically-heated back surface. The

enhances separation, but increasing the

recharge rate diminishes it.

the case of vertical or steeply dipping frac-

ten the best recourse is to reinject the

James A. Van Allen, President; Charles L. Drake, President-Elect; Leshe H. Meredith.

Officers of the Union

Bell (News), Bruce Doe, C. Siewart Gillmor

one of the editors named below and one copy to

lion in fiscal 1985, an increase of \$22.3 million. The largest boost-25% -within this activity would go to the satellite services subactivity. The \$84.9 million allocated would allow NOAA to assume responsibility for the Gilmore Creek, Alaska, data acquisition station now operated by NASA, and would fund operation processing of solar backscatter altraviolet data and for correction of system debeiencies in the polar ground system. In addition, the geostationary satellite's temperature and moisture sounding capability would be converted from a research prototype to an operation system by appgrading the ground

Satellite systems, the largest subactivity, is stated for a 4.1% hike to \$164.2 million, which would allow the procurement of a spacecraft and associated launch services to continue to convert to a one polar satellite. system. Funding for the last subactivity, data and information services, would show a 1.4% drop to \$22.6 million.

Ocean and Coastal Programs

Next largest of ORF's activities, called ocean and coastal programs, allocated \$106.1 million (a drop of better than 25%), is itself divided into six categories: nonliving marine resources (cut by nearly two-thirds to \$1.3) million), orean research (on by one-third to \$18.0 million), ocean services (down 29.6%) to \$19.1 million), Sea Grant tonce again proposed for elimination), mapping, charting, and geodesy programs (slated to increase by 25% to \$62.2 million), and coastal zone management, which in the past Congress has budgeted separately (slated to receive \$5.6 mil-

Within nonliving marine resources, the budger request proposes to eliminate the po-lymetallic sulfide program and the ocean

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thymol blue (thymolsulphonephthalein) ti-

trated to the end point). When the wires

are electrically charged, the current flow

and resulting pH change cause the solu-

tion passing over the wires to turn blue.

Continued application of voltage on many such wires distributed throughout the

fracture reveals the steady state streamline

ously prepared volume of blue solution is

injected into the recharge just before en-

try into the fracture. One then observes

this method is analogous to the tracer

technique used in actual reservoirs.

perature. At a moderate Grashof/

the time-development of the fluid motion;

In (a) the density difference is zero and

the tightly bunched streamline pattern re-

lustrates flow "short circuiting," which re-sults in rapid reduction of eliluent tem-

Reynolds number ratio, 2, the tracer tech-

nique reveals the flow pattern in (b), in which a substantial fraction of the re-

charge first flows downward, thus delay-

ing thermal degradation of the effluent.

For a very large Grashof/Reynolds num-

ber ratio, 40, the patterns in (c) and (d) re-

sult. Using the tracer technique, (c) shows

the formation of a descending jet. The

motion after the jet encounters the frac-

ture bottom, turns, and then flows to the extraction tube; thermal degradation is

delayed for the maximum possible dura-

tion. The oscillatory appearance of the de-

scending jet in (c) is due to the Kelvin-Helmholtz shear instability. Another, more familiar example is the formation of

water waves from the wind. (Photos cour-

tesy of investigators Hugh Murphy, Scott Faas (now at Sandia National Labora-

torics, Livermore, Calif.), and Paul Nab-

holz (now at SEDCO, Inc., Dallas, Tex.),

Los Alamos National Laboratory, Los Ala-

mos, NM 87545.)

charged wires depict, in (d), the water

patterns. In the second method, a previ-

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thermal energy conversion program. Cuts to the ocean research subactivity include terminating the Undersea Research Program and Strinking the OASTS/LOGA project. Also proposed is the closing of the Great Lakes Environmental Research Laboratory (GLERL); the fiscal 1984 budget request also proposed to close the laboratory (Eas. May 17. 1983, p. 378), but Congress restored ir.

Increases for the ocean services subartivity ne proposed to cover the cost of producing tide and current publications; receipts from charges for this service will be deposited in the federal treasury. Decreases are proposed for, among others, the circulatory program, the marine boundary survey program, the Chesapeake Bay study, and the bathymetric wath survey system project. The fiscal 1985 sudget proposes to terminate the Sea Grant Program: Congress has restored the program

Although the program level will remain the sine for the mapping, charting, and geodesy subactivity, decreases are proposed in acronautical chart services and nautical chart services. Direct funding of technical support to state geodesy programs would be reduced and a state-specific geodetic survey program would be eliminated. The president's budget requests that mantical and acromatical chart. prices be increased to more accurately reflect. heir full market value.

Coastal zone management (CZM) has been included in ocean and coastal programs with a proposal to phase out the CZM state grants. program, to climinate the states' assistance program, and to reduce the estructure sanctuarv program

Marine Fishers & Program Support

The marine fishery resource programs, the fourth activity within ORF, is budgeted for a 35-5% cur to \$92.6 million. This mdudes \$59.1 million (down \$12.7 million) for information collection and analysis, \$29.1 million (down \$21.1 million) for conservation and management operations, and 54.1 million (down \$17.2 unilion) for state and indusus programs.

ORF's last activity, program support, has been allocated \$92.8 million, a cut of 17.2% from fiscal 1984. Proposed decreases include climinating the National Advisory Committee on Oceans and Atmosphere (NACOA), reducing general administration, deactivating the fisheries research fleet, reducing days at sea, laying up of the Surveyor and the Ferrel, reducing maintenance on both those ships and on Freemon, and closing the southeast marine support facility.—BTR

Space Station **Proposed**

In his State of the Union address on January 25, President Ronald Reagan announced that he was directing the National Aeronaunes and Space Administration (NASA) to "develop a permanently manned space station. and to do it within a decade.

Included in the NASA budget proposal sent to Congress the following week was \$150million for the station. This is the first request of many; expected costs will total. roughly \$8 billion by the early 1990's.

As corrently configured, the space station will be lannelied and tended by the space. shuttle and provide living and working space for a crew of 6-8 people. Some tree flying, unpressurized platforms would carry sensitive instruments that could not function with the natural jostlings of manuel modules, NASA, which has been lobbying tor a space station for several years, has invited international particas ations

Not everyone agrees that a space station would, in the words of President Reagan. "permit quaitum leaps in our research in scr ence, communications, and in metals and life saving medicines which can be manufactured. only in space." A report issued by the National Research Conneil's Space Science Board asserted that there is no security need for such an endeavor for at least 2 docades. In addifrom some researchers worry that the program will detract both funds and anounton from other programs:

Gravity Theory Test Planned

ministration (NASA) has decided to proceed with one of the most sophisticated attempts certo test Emstern's gravitational theory. The proposed Gassis Probe Banstramented spacecraft program has been included in the genev's Fiscal Year 1985 budget request, but only after considerable in-depth evaluation. hoth scientific and financial. Budgeted at \$1.8 million for study in fiscal year, 1984, it has been proposed at \$3-5 million in fiscal year 1985 under the Physics and Astronomy Research and Analysis section of NASA's bud-

The idea of Gravity Probe B is to test the general theory of relativity by examining in line detail changes of the precision parameters of an earth orbiting gyroscope (Science, 223, 30, 1984). The gyroscope will be a cryogenically cooled, highly sensitive instrument pecifically designed for the measurements. The engineering concepts have been under development for decades, and although the effects being sought are subtle, the experinent is considered to be within the realm of

As with almost all experiments designed to est general relativity theory. Gravity Probe B has the appeal of making a substantial contrioution to basic physics as well as to astrophysics and geophysics. At the same time, such a contribution carries the stigma of being basic and difficult to obtain and thus a bit far out of the main stream of space science projects.

NASA lei the scientific community decide on this project in the sense that a great demonstration of support from a broad sector of scientists could be justification for new fundto compete with other planned projects for a place in the existing budget request. "Deputy dministrator Hans Mark has simply threatened to delete it from the agency's budget. It s an unusual teclinique to say the least, but Active: the space science community is ddiging him with profess, letters, and outaged statements of support for the mission." eccording to Science.

This "outrage" resulted in strong endorsenent by the Space Science Board and from many powerful supporters within the sciendic community. Assuming the the budgets are approved. Gravity Probe B will fly in the early 1990's.---PMB

Active Faulting Near Taupo

The only confirmed lault displacement in New Zealand since that accompanying the 1968 Imangahua Earthquake was observed on June 23 and 24, 1983, 4 km west of Taupo in the Taupo Volcanic Zone, central North Island (Figure 1). Normal displacement occurred on the late Quaternary Kaiapo fault,

previously active in 1922, when almost 1 in ofnormal fault displacement was observed. [todage, 1932]. The Karapo Lault is one of a number of north-east trending normal faults that constitute the active Loopo Lault Belt. [Gandley 1961] Current extension cuts up to 7 mm per year have been calculated from georietic observations (Nissons, 1979) across the northern part of the Laupo Volcane.

Maximum displacement 2 km north of Take Tampo was 50 mm upthrow to the southeast with 30 from extension across the steeply dipping normal fault. No stude-slipdisplacement was observed. Foral length of the observed 1983 surface trace is 1200 m. comprising a ser of rensional cracks up to 10 in in length, locally left stepping on echelonin nature (Figure 2):

Following several Modified Mercalli (MM) 4-5 intensity earthquakes reported on June 20 and 24, 1983, a local resident nonced a number of cracks near the base of the fault scarp on his property south of Mapara Road Following more MM/3 and 4 carthquakes on the night of June 23, the cracks propagated to the northeast and on the morning of June 24, a scientific inspection team observed displacement of the surface of Manara Road.

These earthquakes were part of a local swarm that had commenced on June 16. Earthquake magnitudes were up to 3.9 with a maximum of 20 telt events per day. Earthquake activity in the area of the fault displacement died away by June 29, migrating arst to the north then to the south below Lake Taupo. Active fault displacement appears to have ceased following June 23, although seismicity and minor ground detormation continued.

The surface displacement occurred within the Kaiano tilt-leveling pattern, one of 12 such arrays regularly monitored by New Zealand Geological Survey around Lake Tampo; 47 mm of displacement was measured on one of the 600-m long precise-leveling radials in agreement with the observed surface dis-placement. In addition, regular measurements of Lake Taupo water level taken as part of a regional vertical deformation monitoring program recorded relative unlift in the epicentral area for at least 3 months prior to the swarm. Rapid subsidence totaling 50 mm and displacement at the Kaiapo Fault were associated with the earthquake swarm (Figure

Prior to the Kaiapo faulting, during auearthquake swarm on the western margin of the Taupo Volcanic Zone in February-March 1983, a seismographic network was established for one week west of Kudoch (Figure) 1). Associated regional uplift (Figure 3) led to additional lake leveling stations being in-

After the Kaiapo faulting, seismographs were again deployed around the northern shores of Lake Taupo from June 29, 1983, until July 4, 1983, recording events largely to the south of the surface Ludt displacement. that of magnitude 4.3 on July 1 being the largest event recorded. A composite focal

News (cont. on p. 52)

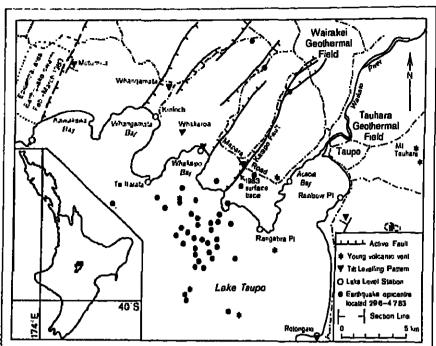


Fig. 1 Northern Lake Faupo region showing epicemers of early July 1988 earthquakes in relation to active faulting and young volcanic centers. Location of Kajapo Fault break



Fig. 2 Detail of surface trace with animal track doplaced 50 mm down to the northwest and 20 mm extension. Hammer is 33 cm in length.

mechanism gave a horizontal F-W tensional axis in agreement with regional extension. Epicentral positions, focal depth and mechamsus, and b values are all preliminary. The h value of 0.75 ± 0.11 is similar to that determined in the nearly Warraker Georhermal Field [Hint and Latter, 1982] and to that deternined in the early 1983 Kinloch swarm (f. II. Webb, personal communication.)

Officers of New Zealand Geological Survey and Seismological Observatory, Geophysics Division Department of Scientific and Industrial Research, are responsible for geodetic. geologic. Take level and seismichy observa-

tions both at the 1983 fault trace and elsewhere within the Lake Taupo Region. Precise leveling on some of a 50-km transect of the Taupo Fault Belt to the north is currently being repeated by the Department of Lands and Survey to look for undetected surface deformation. Detailed results are to be presented at the forth oming Recent Crusta Movements Symposium to be held in Wel-lington, New Zealand this mouth.

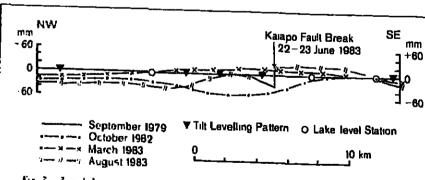
Further information is available from A. G. Jull and G. W. Grindley, New Zealand Geological Survey, Box 30-368, Lower Plutt (geology); P. M. Otway, New Zealand Geological Survey, and T. M. Hunt, Geophysics Division, DSIR, Private Bag, Taupo (geolesy, lake leveling, seismicity); and Irom T. H. Webb, Seismological Laboratory, California Institute of Technology, Pasadena, CA 91109 (seismolo-

Grange, L. T., Fanpo earthquakes, 1922: Rents and faults formed during earthquake of 1922 m. Faupo district, N.Z. J. Sci. Feshnol. 14, 139-141, 1932.

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This news tiem was contributed by Alan G. Hull and George W. Grindley, who are with the New Zealand Geological Survey, Lower Hutt, New



Fig=7 - I exel changes across Lampo Fault Belt before and after the earthquake swarm and hards for also latter four and early July 1983. For position of line see Figure 1.

VLBI Observatory **Begins Operations**

A new rador relevope observatory located at Radamond, Flacture at Mannit, made its first special Very Long Baseline Interlegemetrs (VI Bl) observations on December 9, 1983, grouding to the Sational Geodetic Survey. (SGS). This test residu was followed on Decouldry 21 by the first operational observing session of the full, three station POLARIS (Polar Monton Analysis by Radio Interlepemetric Surveyings netson'k (the Richmond faeilus plus abservatories irear Borion. Mass. and El Papi. Tex i.

the POI ARIS network was joined in the historic Beautiful 21 observing session by VI.B) observatories in Univila, Sweden, and Westrell Festeral Republic of Germany, Only 8 hours of operations vielded sufficient data so determine the location of the Rechmond site relative to the other four North Ameriente and é aregionn construires to wethink fraction of a circler. Referenceits will quickly

reduce uncertainties to a few centimeters Regular, 24-hour observing sessions with the POLARIS network will allow gendesists to monitor the wohlle of the earth on its axis—a phenomenon known as polar motion—and variations in the rate of rotation of the earth, e., the passage of Universal Time. The PO-LARIS stations will also be used in conjunction with mobile VI B1 systmes to study deformation of the North American rectonic plate, and with observations on different plates to study global plate motions.

The first successful observations from the Richmond POI ARIS observatory culminated nearly 7 years of planning and building by NGS (a component of the National Oceanic and Atmospheric Administration), the U.S. Naval Observatory, and the National Aero-namics and State Administration (NASA) mantics and Space Administration (NASA), aided by several other organizations. The 17in diameter radio telescope was donated by

the Carnegie Institution of Washington. All three POLARIS observatories are pped with the state-of-the-art Mark III Vi.Bl data acquisition system, developed by a team of scientists and engineers from the Massachusetts Institute of Technology, Hay-stack Observatory, the National Radio Astronomy Observatory, and Goddard Space Flight Center, under funding from NASA and the National Science Foundation. The Mark III VLBI system can record as many as 112 million bits of data per second. During a typical 24-hour observing session, each observatory records more than a trillion bits of data. The entire process of collecting and reducing the data relies heavily on computer-

The first two POLARIS observatories have been operating for nearly 3 years. The PO-LARIS length-of-day series captured an extraordinary change in the rate of rotation of the carth during January and February 1983, coincident with the strongest episode of the El Nino ever recorded. Early success of project POLARIS has led scientists in several other nations to develop dedicated geodetic VLBI observatories. The first operating foreign observatory is located in the village of Wettzell in Bavaria, Federal Republic of Germany. Others are nearing completion in Japan and the People's Republic of China. Together with the POLARIS observatories, these stations will form a global geodetic VLBI network, known as the International Radio Interferometric Surveying (IRIS) sys-

The IRIS stations are also supporting an even broader international effort, organized by the International Uttion of Geodesy and Geophysics and the International Astronomi cal Union, known as project MERIT (Monitor Farth Rotation and Intercompare the Techniques of observation and analysis). Project MERIT involves the application of several advanced technologies (including VLBI, satellite laser ranging, and lunar laser ranging) to the study of the dynamics of the earth.

This news note was contributed by William E. Carter, who is with the National Geodetic Survey. Rockville, MD 20852.

Molecular Computers

Computer circuits consisting of organic molecules could offer a solution to problems toreseen in future processor designs, Geophysicists and astronomers are among those needing huge, ultrafast computational facilities. It takes the ultimate in computing power to track fluid flow in petroleum reservoirs, to analyze data from 3-dimensional instrument arrays, and to conduct imaging measure-

ments of planetary surfaces in reactime. In a sense, silicon and germanium integrated computer circuit designs are running out of the time-space dimensions to fill the need. Organic molecular circuits, some of which will contain no metallic conduction elements as normally conceived, may be able to be produced with appropriately small time delays and physical dimensions between electronic elements. Because of limitations of conventional integrated circuits, the number of transistors that can be fabricated onto a single chip may never exceed 0.6-1 x 10", This number may have no relevance to molecular computer circuits, in which logically based entities provide intelligent switches much like

those of living systems. A molecular computer is still a long way from being a reality, but interest in their po-tential is rising rapidly. In a recent workshop on chemical-based computers, sponsored by the National Science Foundation, new avenues for research were being considered. F Eugene Vates, head of the Crump Medical Institute of the University of California, which cosponsored the conference, stated, "H we go to a molecular computer . . . we're talking about achieving spacing of elements 1/ 1,000th of that [attainable with silicon] . . we could probably increase computational diversity between 1 and 10 million times what can be done at present" (Research and Development, January 1984).

A competitive molecular computer may not arrive until the next century; however, when it does appear its properties may be impresprobled is the application of current biological engineering, ranging from those related to recombinant DNA to protein and enzymes. The new biological computer could have "mood" changes to aid in parallel processing of signals. Molecular electronics in general is likely to exploit the full range of piochemical advances. The existing discovery of organic superconductors may find useful application in producing the first resistancefree conduction actually used in computers.—

Cornell **Continents Institute**

Cornell University has formed a new research unit to study the origin and evolution of the continents. Inhially, the new Institute for the Study of the Continents will comprise research efforts in geological sciences at Cornell now carried out under the Cornell Program for the Study of the Continents, the Consortium for Continental Reflection Profiling Project, the Andean Project, and related studies of crustal geology. The institute will be quartered with the Department of Geological Sciences in Suce Hall, an earth science facility now under construction. Jack Oliver, former chairman of the Department of Geological Sciences, has been appointed to a 5year term as first director of the Institute.

This news tem was contributed by Thomas Everhart, who is with the College of Engineering, Cornell University, Ithaca, NY 14853 0125

Geophysicists



Peter S. Engleson, of the Massachuseus Institute of Technology civil engineering de-partment, has been named Edmund K. Turner Professor of Civil Engineering, Currently president of the AGU Hydrology Section, Eagleson in 1979 received the section's Horron Award. Eagleson has been a member of the MIT faculty since 1955 and was chairman of the civil engineering department from 1970 to 1975.

Peter Brewer returned to the Woods Hole Oceanographic Institution after 2 years as the program director for the marine chemistry ogram in the National Science Foundation's Division of Ocean Sciences. Cartis A. Collins has returned to the division as program manager for ocean dynamics after spending I year at Woods Hole as a guest investigator in physical oceanography.

Tjeerd Van Andel, professor of occanography at Stanford University, has been awarded the Van Waterschoor Van Der Gracht medalfrom the Royal Netherlands Geological Society for his lifetime contributions to the earth

John G. Weihaupt, formerly the dean of graduate studies and research at San Jose State University in San Jose, Calit., is the new vice chancellor for academic affairs at the University of Colorado in Denver

Recent Ph.D.'s

East periodically lists information on recently at repred doctoral dissertations in the disciplines of geophysics. Faculty members are invited to submit the following information, on institution letterhead, above the signature of the faculty advisor or department chairman:

(1) the dissertation (ide.

(3) name of the degree-granting department and (d) faculty advisor

(5) month and year degree was awarded. If possible include the current address and tele-

phone number of the degree recipient (this infortion will not be published). Dissertations with order numbers, and many or the others listed, are available from University Mi-crollins International, Dissertation Copies, P.O.

Boy 1764, Ann Arbor, MI 48106. Analysis of Solution and Gas Phase Molecular States of Formaldehyde by Gus Chromatography and Chemical Ionization Mass Spectrometry, Da vid F. Utterback, Univ. of North Carolina, Chapel Hill, 1983 (GAN83-26261).

Application of Optimization Methods to the Inverviou of Aeromagnetic Data (Brazil), Laurenildo W. B. Leite, Saint Louis Univ., 1983 (GAX83-

Association of Cobalt, Nickel, Copper, and Zinc With Iron and Manganese Oxides of Soils, James A. Frampton, Univ. of California, Davis, 1983 (GAX83-26072).

Clastogenic Activity of Phenolic Oxidation Products, Ann F. Hanham, Univ. of British Columbia

Diagenesis and Reservoir Qualities of the Jurassic Navajo (Nugget) Sandstone in Utah and Southwestern Wroming, Kadir Uvgur, Univ. of 1983 (CAX83-25942).

Differentiation of the Nebo Granite (Main Bushreld Granite), South Africa, Dennis R. Mac-Caskie, Univ. of Oregon, 1983 (GAX83-25284) Effect of Organic Pore Fluids on the Fabric and Geotechnical Behavior of Clays, Eileen D. Gilligan, Syrucuse Univ., 1983 (GAX83-25284).



<u>Books</u>

Carbon Dioxide and Climate: A Second Assessment

Report of the CO/Climate Review Panel, National Rescurch Council, National Academy Press, Washington, D. C., xx + 72 pp., 1982.

The Long-Term Impacts of Increasing Atmospheric Carbon Dioxide Levels

G. J. MacDonald (Ed.), Ballinger, Cambridge, Mass., xxiv + 252 pp., 1982, \$35.

Reviewed by A. Berger

Introduction

There are quite a large number of excellent publications now available in the domain of carbon dioxide and climate. After a period of intense research on the subject conducted under the sponsorship of national and international institutions like the U.S. National Research Council, the U.S. Department of Energy, the Environment Agency of the Federal Republic of Germany, the Scientific Committee on Problems of the Environment, the International Institute for Applied Systems Analysis, the World Climate Program, the Commission of the European Communities and others, syntheses are now possible.

Over the past decades, extreme climatic events in different parts of the world have made us aware of our vidnerability to climatic variations and variability. But it is also more and more recognized that not only man may possibly be affected by climate but also that climate is vulnerable to man's activities. These human activities, especially those related to industrial processes and the practice of agricultural burning and soil management, result in the release of particles and trace gases in the atmosphere. The increase of atmospheric CO2 which is worldwide poses a special problem of major concern-

Since the beginning of industrialization in the last continy, a steady increase in energy consumption was observed with a growth rate of about 5.397 per year. The history of carbon dioxide production from fossil fuel combustion and cement production is related to the history of global energy demand; their rate of growth, at least before the energy crisis, was slightly less than 4.3%. The fraction of CO2 emissions remaining airborne is around 50%; although this amount is variable from year to year, it resulted in an increase of the atmospheric COs level by about 20% since the beginning of the industrial era: The pre-1850 value is estimated to be 260 parts per million by volume (ppmy); it was 290 ppmy around 1900 and the 340 ppmy value was exceeded for the first time in 1981 (which represents roughly 710 Gronnes of carbon as carbon dioxide in the atmosphere) If energy consumption follows current projections, it seems probable, based on present knowledge of the carbon cycle, that atmospheric CO2 will increase to a level of about 380 ppmy by the end of the century and reach twice the pre-industrial level around 2050 A.D. or even 2080 A.D. (Th. D. Potter, World Climate Program Newsletter, 4, 1983). This will inevitably lead to changes in the climate system and present estimates center around a global average value of 2-3°C surface air temperature increase per doubling of atmospheric CO2 concentration, with a 3-4 fold temperature increase in northern polar regions. However, due to the inertia of the oceanic response, temperature increases are expected to follow the CO; increase with a lag of 10-20 years.

The NRC Report

In screening the existing knowledge, Car-bon Diaxide and Climate: A Second Assessment (the report of the CO2-Climate review panel of the U.S. National Research Council, chaired by J. Smugorinsky of the Geophysical Fluid Dynamics Laboratory), concluded that previous results published in the Charney report (Climate Research Board, 1979), which nferred a relationship between man-made changes in atmospheric composition and sub stantial climate effects, remain unchanged: "An increase of carbon dioxide in the atmosphere by a factor of 2 would cause the average global surface temperature to increase by $3 \pm 1.5^{\circ}\mathrm{C}$ and no overlooked or underestimated physical effects were found that could reduce this currently estimated global warmng to negligible proportions or reverse them

This report focuses only on the climatolog cal aspect of the CO₂ problem and conclusions were drawn principally from the present-day numerical models of the climate sys tem. There are 4 main chapters:

1. Introduction and overview, dealing with some historical background of the CO2-cli-

2. Principal scientific issues in modelling studies, where the global climate sensitivity is analyzed from simplified models and empirical approaches; the role of the occan in the transient response of climate and of sea-ice i discussed; the cloud effects me tremed brough the cloudiness-radiation feedback and the stratus-sea-ice interactions; trace gases other than CO2 and atmospheric acrosols re recognized as providing another potentially significant and complex source of cli-mate variability; and finally the need for

improvement are reviewed. 3. Predictions and scenarios of climate changes due to CO2 increases, where the global-average, the zonal, and the geographic responses to scenarios of CO2 increase are investigated not only through a 1-dimension radiative-convective model but also through comprehensive General Circulation Models of the joint ocean-atmosphere system. Various observational studies are shown to provide a useful starting point for diagnosis of climatic processes that may prove to be relevant to the CO2 problem, but have certain problems and imitations that deserve comments.

model validation, their current state and the

4. Early detection strategies and monitor ing of the ocean climate response, where it is suggested that early indications of CO2-induced changes can perhaps be found in zonal-mean summer temperatures in the stratosphere and mesosphere, in satellite remote temperature sounding data, in the temperature of the deep ocean layers, in the weighter mean global mass integral of the atmospheric temperature or in the sea-ice extent. However, the early detection of the CO2-climate signal requires not only a prediction of the CO2 induced climate change but also a knowledge of the natural climate variabilities. Therefore operational monitoring of the ocean and atnosphere is not only required but it is also necessary to determine from the past dimatic records the variability of relevant chinatic var-

NRC Conclusions

In summary, the panel reached the follow-

(1) The sensurity of global-mean temperature to increased atmospheric CO; estimated from simplified models is generally consistent with that estimated from more complete

(2) Global-mean surface warming is drive to by radiative heating of the entire surface-armosphere system; land surface processes interact with climatic changes in ways that are ver poorly understood.

(3) The heat capacity of the upper ocean is potentially great enough to slow down substantially the response of climate to increasing atmosoheric CO2.

(4) The lagging ocean thermal response may cause important regional differences in climatic response to increasing CO: (5) It is premature to draw conclusions regarding the influence of clouds on climate

ensitivity to increased CO2. (6) The climatic effects of afterations in the concentrations of trace gases can be substan-

(7) Atmospheric aerosols are a potentially significant source of climate variability, but he climatic impact of their changes cannot currently be determined.

(8) Comparisons of simulated time means of a number of climatic variables with observations show that modern climate models provide a reasonably satisfactory simulation of the present large-scale global climate and its average seasonal changes.

(9) Observed surface temperatures of Mars. earth, and Venus confirm the existence, nature, and magnitude of the greenhouse ef-(10) Model-derived estimates of globally.

and perhaps zonally, averaged temperature changes appear to have some predictive rel biny for a prescribed COs perturbation (11) Observational studies play an impor

tant role in the formulation and the general validation of models, the construction of climate scenarios, and the determination of the natural climatic background against which a CO2 man-induced climatic change will have to be tested.

In the frame of its conclusions, the panel has come to recommend the following research and action:

(1) Theoretical and empirical studies of the climatic effects of increased CO2 must properly account for all significant processes involved, notably changes in the tropospheric energy budget and the effects of ocean storid atmospheric and oceanic transport of

(2) Empirical approaches to estimating climatic sensitivity, particularly those employing satellite radiation budget measurements. should be encouraged

(3) The role of the ocean in time-dependent climatic response must receive special at tention in future modeling studies. (4) Future efforts should be directed to-

ward the further improvement of the param eterizations of physical processes that are

poorly understood at present, i.e., cloud forpation, moist convection, and land-surface

(5) The most radiatively significant trace gases must be monitored. (6) The climatic impact of changes in anthropogenic aerosols must be better deter-

(7) A comprehensive dimate model valida tion effort must be pursued.

(8) Further analyses and diagnostic studies based on past and contemporary climatic data sets should be encouraged. (9) A set of indices that have a large signalto-noise ratio with respect to CO2-induced

changes should be identified and monitored. (10) CO2 transient response experiments and CO) climate equilibrium sensitivity experiments must continue. The investigation of the transient response from occan-atmosphere general circulation must be pursued.

(11) To determine the geographical details of a CO2 induced climate change, it would be necessary to develop climate models with improved computational resolution.

This very clear report, written in a concise format, provides not only an excellent view of the most recent results on the CO2 impacts on climate but also analyzes critically the limitations of the present models and observation data set. Accordingly, the experts of the panel concluded with recommendations which are going to be landmarks for research in the

A Broader Look

The Long-Ferm Impacts of Increasing Atmo sphere Carbon Dioxide Levels, edited by G. J. MacDonald, is much broader in scope than the National Academy report: it does not lim it useff to chinaric impacts but covers also sources and sinks for carbon dioxide (part 4). models of chinate change resulting from changes in the chemical composition of the atmosphere (part 2), some consequences of changing the composition of the atmosphere and research needs (part 3) In fact, the book is built to document the

Tollowing statement up Avini: "Since carbon dioxide is transparent, or almost so, to sunlight but absorbs energy radiated by the earth in the infrared part of the spectrum, carbon dioxide plays a key role in determining the mean temperature of the atmosphere, its Nathuren with height and Littinde, and thus the dimage of the earth. Carbon dioxide can take affect the rate at which plants grow and store carbon. Reacting with water, carbon diloxide can change the acidity of rivers, lakes, and oceans and possibly perturb biological ac-

Significant macertainnes exist in the four main aspects of the CO2-dimate problem: (1) the rate of GO2 production, both natural and man-made (the fatter by an increasing energy consumption due to improvement of lite conditions and expansion of world populations: (2) the increase of atmospheric CO2, which is related to the carbon cycle; (3) the modeling of the climate, and (4) biosphere response to changes in aumospheric CO2 concentration. The possible benefits and costs of these changes to society fully justify the need for such a book, which considerably helps to het-

ter understand the overall CO2-climate model and its weaknesses.

Chapter 2 discusses the contribution to atmospheric carbon dioxide due to the burning of a wide range of natural and symbolic luels. The values listed must be used with caution as some more efficient land uses produce less amount of carbon per unit of thermal or electric energy generated: a conventional, coal-fixed electrical power plant releases 5 times as much carbon as natural gas does, synthetic gas and oil roughly 3 times, and natural shale oil and coal around 2 times (methane releases 13.8 kg carbon per 10° J. more or less the same as does hydrogen from natural gas reforming). Future fuel uses are then estimated to provide a base for luture atmospheric levels of carbon dioxide. Unfor tunately only two conservative scenarios are considered: (1) with the present fuel mix. 1400 additional Ctonnes of carbon will be deposited to the 1978 atmosphere by the year 2035 if the historical growth rate is maintained; (2) with a tapered growth rate thistorical growth rate maintained to 1990 and then decreasing linearly to zero over the fiftyyear period 1990-2040), the date is pushed torward 20 years. A communison with much more efficient scenarios, as described in Bach (Progress in Physical Geography, 6(4), 549-560. 1982), would have been of real interest; for example, for the 16 TW Commission of European Communities scenario, the cumulative thon emitted into the atmosphere since : 1978 would be only 350 Gronnes by 2035.

As the terrestrial and marine biosphere act as a source and sink for carbon dioxide and as the carbon cycle is closely coincid in nature to the oxygen cycle, the following matters are then reviewed in chapter 3; the response of nannal vegetation to increasing atmospheric CO, talso in chapter 13), the effects of deforestation crosion, the enthro placation of the ocean; the oxygen balance sheet, the minor reactions contributing to the oxygen (yele and oxygen in the ocean tell). matural oxygen deficit of the oceans not only armounts 3000 Coornes but is incleasing at a rate of 10 Gronnes of oxygen per year which remains to be explained through direct and indirect effects of human activity)

The rate at which the ocean can absorb carbon dioxide, depending on how the sur Tare layers of the ocean mix with the deepe parts, is simulated through the Pipe Model. which emphasizes the physical, biological, and chemical process at the occan boundaries. an interesting hydrodynamic inising alternarive to the more usual diffusive box models

Estimating Fution Levels

For estimating the farme levels of CO2, a model of the atmosphere biosphere occanic interactions is presented in chapter 5, where the importance of the biospheric and oceanic uptake of carbon and the possible feedback from large carbon reservoirs are illustrated. The dates on which the carbon dioxide content doubles range from 2003 to 2085, depending on the assumed absorption capacity of the oceans and biosphere and whether the carbon-based fuel contribution grows at a ta-

T. A. Potemra, Editor

Books (cont. on p. 54)

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Books (cont from p. 53)

pered rate and the present fuel mix is mainiamed. But, given the large uncertainties involved and only the two energy scenarios used, 2035 appears to be a reasonable estimare, which is definitely at the pessionistic side when compared with the more recent projections of about 2070. Furthermore, a worldwide warming will tend to produce a positive teedback releasing curbon from the oth, methane hydrates, and the oceans, although there remains uncertainty as to whether these large carbon pools will play a significant role in enhancing the GOz-in-

duied chinate change Chapters 6, 8, and 9 review the fundamentals for simulating changes in the planetary heat balance from chemical changes in the atmosphere, considering models of the atmosphere in which radiation is the only merhanism by which energy is transferred. The equivalent quangray radiative atmosphere gives a $\Delta T_{\infty} \approx 2.8$ K at the CO2 content were doubled. A zonal energy balance model and a simple band model for infrared emission : from the terrestrial atmosphere show that the ΔT tecdback from the additional water burden that the armosphere can support in maintaining a constant relative formulity, is comparable to the AT produced directly by an increase in CO2. This illustrates the importance of the water vapor feedback which was dearly demonstrated by Ramanathan (found Atmosphere Sciences, 18(5), 918-930, 1980): The primary contribution to the $(2,\kappa)$ CO2) surface warming (2.2 C) is indeed from the enhanced tropospheric IR emission due to the increased evaporation from the warm-er occan in a CO2 (tele atmosphere (1.7°C). This is an order of magnitude greater than the direct CO; tailiative heating at the surtace (0.17°C), the durd process involved bemg related to the downward component of

The addition to the atmosphere of minor constituents that absorb in the 8 to 12 µm band could also be important (chapter 7): An mercase of 10% times would place the freons in the chinate critical category; for both metronvoxide and methane, which sit in regions where there is already strong absorption, factors of 2 are important. Although incertainnes do exist in the strength of biture sources, in the atmospheric chemistry, and in the acmospheric feedbacks, an additional 1.5 K increase in average on face temperature is antropaced in the und-21st century as a result. of an increase by a factor of 2 in CH ciproduced mainly from the anacrobic termentanon of organic material: 0.3 Kt. 1.5 in N20 tesenually due to the use of ammonia based terribgers, 0 4 K), 10 in freons (0.1 K), 1.5 in CO to by product of the incomplete combusnon of hydrocarbon fuels: 0.6 K) and 15 m Chain and released from the electrolytic reduction of alternation (L.E.K)

the amplified atmospheric IR emission

Human Impacts

Finally, part 3 is devoted to some particularly important consequences of man's impacts on the composition of the armosphere. After a short discussion on the use of models to produce climate (chapter 10), the failtudes dependance of the changing temperature is discussed (in chapter 11) with its effects on the distribution of sea-ace and, as a result, on the ocean circulation and on the marine biosphere. For example, an increase of the average ocean temperature by 4°C would ultimately release about one-seventh of the presemb dissolved CO; content of the atmosphere and a polar, CO:-induced warmnig will probably weaken the deep water pumps, although its sensitivity remains very hard to assess

The impact of the warming on the most voluerable part of the Antauctic ice mass, the West Antarctic me dieer grounded below sealevel, is then considered in chapter 12, a useful review of the basic physics of ice flow and creep being given in the appendix. On the basis of very simple mechanical considerations, the creep thinning of marine-based ice streams could be fast cromph to draw down the we sheet in as had presion of whether a polar warming due to COrdonbling could remove we shelves sufficiently to infrare such mechanical desirregration has no clear answer at the moment, but

ments attention because of other crucial events traggered, namely the 5 marise in sea-

Finally, an impresse in the CO2 content of the amosphere will increase the earlien that tion electric correct of the land and the lines et change the climatic conditions, both changes altering net primary productivity. The nonclimate effects of CO2 as a municut of agricultural and natural plants may be at least as important as the ilimatic effects and needs better attention. For example, in addition to its possible effect as a fembler, the CO produced by fossil fuel burning may also be belping to its rease agricultural yields in reducing the water demand of crop plants in

A summary ends this excellent bank by tre-

(i) the role of the bisophere in the carbon exclete g, more detailed statistical analyses using observed climatic changes are required to the impact of climatic change on the here can be predicted).

(2) the role of the soils and hydrates of

(3) the role of climate models, intermediate in complexity between heat budget models (which cannot provide the details on the climatic parameters which are essential in assessing the long-term impacts on activities such as agriculture) and the global circulation models (whose complexity may hide the underlying physics and which related numerical approximation employed may distort the

long-term interactions), (4) the timing and place where rise in mean temperature will occur (summer or winter, night or day) and its effect on local extremes, (5) the effort in monitoring trace constituents which can enhance the greenhouse ef-

(6) detecting the secular temperature trend against the noise background, and (7) the worldwide nature of the CO2 ques-

Although the climate system possesses many resilient qualities, man's activities may well alter greatly the future climate and in consequence our society itself. It therefore behowes us to not let this experiment, the greatest inadvertent geophysical experiment ever begun, proceed unobserved and uncontrolled. These two hooks will undoubtedly help muhidisciplinary interchanges among the overall community involved in this CO2 problem. Read them.

A. Berger is with the Institute of Astronomy and Grophysics G. Lemaltre of the Catholic University, B-1348 Louvain-la-Neuve, Belgium.

Seismic Reflection Interpretation

A. H. Kleyn, Applied Science, New York, xii + 269 pp., 1983, \$57.50.

Reviewed by Larry D. Brown

This interesting, albeit uneven, little book reviews a broad range of topics related to the offection and analysis of seismic reflection data. In spite of its misleading title, it deals less with the geological interpretation of reflection sections than with the geometrical analysis of seismic raypaths. For example, statics corrections and migration theorytopics or peripheral interest if not indifference to most interpreters—are subjects of entire chapters while seismic stratigraphy, one of the houest current branches on interpretaion, is not even mentioned!

Title semantics aside, a glance at the table of contents confirms that most of the obligatory topics of an overview are covered: An inttion (chapter 1, brief to the point of extinction)) is followed by a "Review of Basic Principles" (chapter 2) in which retraction. reflection, diffraction, Snell's Law, Fermat's Principle, Fresnel zones, reciprocity, saapling theory, travel-time curves and f-k filtering are variously, though curtly, discussed, chapter 3, "Ceometrical and Analytical Backgrounds," gets to the ray tracing considerations while lie at the heart of this book, deriving time distance relationships for reflections and refractions in layered and continuous media as well discussing CDP data collection technique, NMO and velocity analysis, and multiple reflections and areal surveys, "Static Corrections" are the subject of chapter 4, and chapter 5 ("Reflection, Transmission, and Acoustic Impedance), reviews basic concepts including a discussion of the convolutional

model of reflection response and Gassman's equation for acoustic impedance in porous media. Chapter 6 ("Velocity Measurement in Wells") delves into well logging and its rela-tion to seismic sections. Chapter 7 ("Structural Interpretation of Reflection Information"; attacks the meatier topics of migration geometries in 2 and 3 dimensions, including timeto-depth conversion, and is supplemented in chapter 8 ("Elements of Signal Migration Systems") by a review of Kirchoff and finite ele-

ment approaches to computer migration. The book's primary appeal lies in its tresh been either neglected or inadequately addressed in other texts. The flavor of industry experience enhances many of the treatments The frequent incorporation of 3-dimensional considerations in discussion of analytical and processing procedures is especially welcome, although the 3-D diagrams are among the most confusing in the book, and the vector notation is abruptly introduced. The treatment of reflection time derivatives, examples of spations tex relations from such phenomena as reflected diffractions, time fies at line crowings, and the relationship between the various types of velocity measures are particularly insightful. Some relatively mutudane topks like NMO stretch also receive an unusual airing. The overview of well logging is well done, with a discussion of well shooting as well as acoustic logging. The treatment of migration and structure is particulary thorough with respect to the geometrical aspects, ough with respect to the geometrical aspects, including migration of time contour maps and 3-D data with the usual examples comparing unnigrated and migrated responses of basic structures. A discussion of migration before stack in chapter 8 also deserves mention. An especially useful aspect of this book, is the line cluster of migration of migration of the line clusters. clusion of numerous exercises with solutions (selected to in the book as examples). This of the book as examples of the book a

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problems are unusually fresh and often more nformative than the accompaning text. Also particularly handy are the numerous bibliographical references at the end of each secon, although the use of volume numbers in lieu of page numbers is annoying. Lastly, the numerous seismic sections (lumped, for some unexplicable reason, at the end of the book rather than inserted where they are discussed) are excellent and exceedingly well re-

Unfortunately, the treatment of many of these topics is uneven and often sketchy. According to the preface, the book is based on a series of inclustry lectures, which may account for the frequent impression of that one is reading supplementary notes rather than a fleshed-out text. Many of the basic relations are briefly derived, if at all, and important equations often appear with "it can be shown that "type introductions. Although this brevity may have been an intentional efort to skirt introductory material which can be found elsewhere, the resulting incompleteness will impede readers not already familiar with the material. Many of the figures are unnecessarily confusing, usually because of poor annota-tion and incomplete discussion. To cite but one example: Explanation of how multiple channels are used to collect data in the CDP roll-along manner is relegated to a single, confusing figure of a stacking chart that would baffle anyone not already aware of how roll-along works. There are no true synthetic seismic sections (only travel-time sketches), although they would prove most informative in illustrating many of the principles. While such explanatory omissions might be acceptable when addressing an experienced industry audience, they seriously detract from this book's utility as a general pur-

Another detraction is the uneven and often curious emplhasis of topics. Statics corrections are given a separate chapter, while all other aspects of seismic data processing are lumped under a background chapter. Even the discussion of statics is uneven: Much residual statics barely rates a mention. Resolu-

tion, deconvolution and anglastic attenuation are also barely mentioned. Although refraction is discussed at length, the traditional basic equations for interpreting thicknesses and dips in layered media never appear, except implicity buried in less useful (from the interpretation viewpoint) equations.

Even the more laudable discussions seem

incomplete. For example, after expending considerable worthwhile prose describing various velocity measures, the author virtually skips through a disucussion of the various methods for making such measurments, showing no examples of the most commonly used techniques such as velocity spectra. The computation of various time derivatives which I found rather elegant, is left hanging with no real attempt to point out their physical meaning or usefulness. The problem of vertical time-to-depth conversions seems to me to be unnecessarily entangled with migration aspects, without a clear explanation of the relationship. There is no mention of frequency domain migration although an entire hapter is devoted to Kirchoff and finite difference methods. Although several aspects of seismic data processing are addressed, the treatment is too scattered and incompelete to provide a useful overview of this aspect of reflection seismology. In spite of their excellent quality, the appended seismic sections are little discussed, except to illustrate a few rather limited points. Most of sections exhibit a number of interpretational principles worthy of much more discussion.

Although this book attempts to cover much of the methodology of the reflection seismology, it is too sketchy and uneven to serve alone as an introductory or reference text. Yet its treatment of selected aspects is too useful and novel to overlook. As a supplementary or perhaps refresher text, it is worth. the attention of even experienced exploration geophysicists.

Larry D. Brown is with the Department of Geo-logical Sciences, Cornell University, Ithaca, NY 14853

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Dr. R.A. Freeze, Department of Geological Sciences, University of Bruish Columbia, Vancouver, B.C., Canada, VGT 284, For Jurther information, tele-

organs. The applicant should mentify and uses the areas of his or her expertise which can support ex-perimental or theoretical investigations in space plasma physics and/or auroral physics. Salary and position will be determined by the applicant's quali-fications and experiments.

plasma physics and/or autorial physics. Soary and position will be determined by the applicant's quadrations and experience. A resume and the names of three persons knowledgeable of applicant's experience should be forwarded to: L. A. Frank, Department of Physics & Astronomy, University of Iowa, Van Allen Hall, Iowa City, Iowa 522-12.

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be received by May 6, 1984. NASA Headquarters, Code NHP, Washington, D.C.

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Research Position in Space Plasma and Auroral Physics. Two research positions at the level of assistant or associate research scientists are available in the Department of Physics & Astronomy at the University of Iowa for qualified cambitates with a Ph.D. degree and experience in space plasmas and/or auroral physics. Present research in space plasma physics emphasizes analysis and interpretation of observations of magneto-spheric plasmas using instrumentation on heard earth-orbiting space raft in the IMP and ISEE Missions. The University of Iowa's doubt ingermy instrumentation on the space. Research Position/Department of Oceanography, University of British Columbia. Revent Ph.D. with experience in statistical methods and graphysical thrid dynamics sought to participate in the analysis and interpretation of data from an array of cyclesordes (profiling current meter, CLD systems and current meters in the Strait of Georgia. The candidate should also have the potential of modeling the observations in terms of the non-linear low fromence, motion of a straithed fluid of variable. ling the observations in terms of the non-linear low frequency motion of a straitfied fluid of variable depth. The position is available as of 1 November, 1984, for a duration of one year and may be removed for a second year; it will be filled at postdoctoral (in \$20,700) or research associate top to or \$27,000) level according to the candidates experience. In accordance with Canadian immigration requirements, priority will be given to Canadian integers and permanent residents of Canadian integers and three letters of reference should be sent 1 July 1964 to Dr. S. Pond, Dept. of Oceanography, 6270 University Blyd. Vancouver, B.C., Canada Vo. 1 IW5. the IMP and ISEE Missions. The University of to-wals global imaging instrumentation on the space-cialt Dynamics Explorer 1 is the source of an exten-sive data base of auror al images from high almodes at visible and ultravolet wavelengths. Photometric observations are also available for other areas of re-search including the physics of the upper auro-sphere and the global distribution of aurosphera ozone. The applicant should identify and describe

University of Kentucky. The Department of Geology invites applications for two tentile track facility positions. Areas of specialization are, 1) Geophysical is positions. Meas of specialization are 1) coopins, etc. 2) Structural or Tectom geodogs with some em-phasis on geochemistry, geophysics, geomathematics or periodenin geology. It is anticipated that both po-sitions will be filled at the level of Assistant Professi-tions will be filled at the level of Assistant Profession. smons with a missi and a more sentior person will be tonsidered. Degree of Ph.D. is required.

The Department awards BS, MS, and PhD de-Program Manager/Air-Sea Interaction. NASA Headquarters' Oceanic Processes Branch is seeking candidates for planning, developing and implementing a scientific research program utilizing satellite techniques in the general area of air-sea interaction. Specifically included is the use of satellite scatterometry to characterize the surface wind field, and the effect of surface winds on upper-ocean currents. Qualifications include 1) ability to communicate effectively, 2) demonstrated experience in conducting original research. 3) program management experience, and 4) knowledge of physical oceanography. GS 14/13, with salary ranges from \$41,277 to \$63,115, commensurate with experience/education. For further information regarding requirements and application procedures write to address below or phone 202-735-8687. Formal applications must be received by May 6, 1984. grees. The starting rank and salary depends on qualifications and experience—either industrial or Letters of application should include a full cor-

Letters of application should include a invaria-ulum entaria statement of intent regarding research, names of three referees, and should be addressed to: Dr. Nichola Rast, Chairman of Search Commi-ties, Bowman Hall, Room 255, University of Ken-nicky, Levington, KY 40500–4056, (606) 257-6220. DEADLINETOr application is APRIL 15, 1984. The University of Kentucky is an allumative ac-tion and agreed constraints institution.

Seismologist/Virginia Polytechnic Institute and State University. The Department of Geologica State University. The Department of Geological Sciences at Virginia Tech invites applications for an additional tenure track laculty appointment, at the junior level, in Reflection Seismology, Research Lacilities include a complete VIBROSEIS 48-channel seismic data acquisition system and a dedicated VAX 11/780 computer using DIGICON DISCO seftiems. Applicants must demonstrate a strong research

ppicants must removate a red; preference will be given to those with expe-ice in the theoretical and observational aspects of ection seismology. Faculty members are expected to teach at both the undergraduate and graduate levels, supervise M.S. and Ph.D. theses, and conduct user instruction for a new, computer-automated Rigaku XRD-XRF system, and maintenance and repair of electronic components of other lab facilities in the School. Additional opportunities could include involvement in the University's electron microscopy lab (SEM and TEM), and the development of a Van de Graaf-PIXE analytical system in collaboration with O.U. physicists, Applicants should have a B.S. in Geology, Chemistry, or Electrical Engineering or equivalent in experience; salary is connensurate with qualifications. Send curriculum vitae and names and addresses of three professional references to: an active research program.

Applicants should send a resume and the names

Applicants should send a resume and the names and addresses of three referes to:

1.A. Stoke
Department of Geological Sciences
Virginia Tech
Blacksburg, VA 24001
The appointment will begin September 1984 and candidates are expected to have completed requirements for the Ph.D. by that time. The application deadline is March 15, 1984.
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Dr. David London
School of Geology & Geophysics
University of Oklahoma
Norman, Oklahoma 73019
Deadling for applications is March 15, 1984.
The University of Oklahoma is no affirmative actor/equal opportunity employer. Mineralogical Society of America. Applications are invited for the position of Executive Scaretary. The MSA Executive secretary is the member of the snaff of the American Geophysical Union in Washington, D.C. who is responsible for managing the business activities of the Society. Duties include interest or activities turn at membership, accommbusiness activities of the Society. Duties include the solvement in activities such as membership, accounting, publications, subscription fulfillment and meeting arrangements. Scientific, management, and/or publication background is desirable; idedication, organizational ability, and some knowledge of computer record management are essential. Salary from \$23,000 depending on qualifications and experience. Send resume and names of three references to: Mineralogical Society of America: 2000 Florida Avenue, N.W., Washington, D.C. 20009.

Assistant Professor of Geophysics/Purdue University. The Department of Geosciences, Purdue University anticipates an opening for a new tenure track position at the assistant professor level in the area of exploration geophysics. The successful applicant must be prepared to assist in teaching exploration geophysics courses, advanced topics in his/ler specialty and demonstrate an ability to develop and conduct productive research, Postdoctoral or industrial experience is desirable. The geophysics program in the Department of Geosciences at Purdue University currently consists of four full-time geophysics faculty. Field and laboratory equipment and additios are available for application to seismological and potential field geophysical methods. Excellent computing facilities including a Cyber 205 computer operated by Purdue University and mini-computers within the Department of Geosciences are Faculty Position/University of South Alabama. The Department of Geology and Geography is seeking to fill a tenure-track position at the Assutant Professor level, beginning September, 1984. Applicants should have major training and experience in geological application of remote sensing, and some phase of economic geology. The Ph.D. degree is required. This is a growing department with a present full-time faculty of five geologists and for geographers and approximately 200 majors. Please send resume and arrange for three letters of reference to be sent to: Dr. Gleim R. Schadian, Chairperson, Department of Geology and Geography, University of South Alabama, Mobile, Al. 50688. Applications should be sent before May 15, 1884. The University of South Alabama is an equal opportunity, affirmative action employer. available.
Send letter of application including brief description of research interest and goals, resume and names of three references to:
Don W. Levandowski, Department of Geosciences.
Purdue University, West Lafayette, Indiana 47907.
Closing date for acceptance of application is May
1. 1984 or until the position is fulled.
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Upper Atmosphere Research: USRA Vishing-Scientist/Research-Associate Program at NASA Murshall Space Flight Center. The Universities Space Research Association (USRA) invites applications for a research position in its Visiting-Scientist/Refor a research position in the Vituing-Sciento-Mes-search-Associate Program at NASA Marshall Space Flight Center. Hornwille, Alabama, in the Atmo-spheric Sciences Division of the Systems Dynamics Laboratory. The research will consist of theoretical studies, data analysis, and modelling of the earth's neutral atmosphere above 70 km altitude in collabo-ration with NASA/MSFC vientists. While we partic-plate analysis at the convergence straduction south ration with NASA/MSFC wiemists. While we particularly week applications from recent graduates with the Ph.D. degree in atmospheric science, or a related discipline, consideration will also be given to holders of the Masters degree with appropriate experience. The appointment will be for one year (renewable); salary is competitive.

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Calgate University. The Department of Goology at Colgate University autopates one of more openings in the teaching Leafly beginning in the 1al of 1984. These apenings may include a full-time appointment renewable for a maximum of three wars porniment renewable for a maximum of three wars at the assistant professor level (Fi D) required. A second position at the instructor level would involve primarily laboratory teaching. One position must be filled by a conductor teaching. One position must be filled by a conductor expalde of teaching undergraduate on eanography and/or physical geology. Areas of hirther expertise are presently less restricted and could include any of the following disciplines: Economic Geology, Engineering Geology, Geomorphology, Glacial Geology, Hydrogeology, or Marine Geology.

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The person appointed should take up the post before the end of June 1984. The appointment will be for one year in the first instance and, subject to the satisfactory performance of duties, will be extended for a further two years. FURTHER INFORMATION on the duties of the position may be obtained from Professor D. Boyd — lelephone (08) 228 5843 and Dr P. Brooker — telephone (08) 228 5842 or lelex UNIVAD AA 89141.

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The University reserves the right not to make an appointment or to appoint by invitation.

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majores, and Fragmening To be eligible, confidures must have a Ph.D. or To be engithe, conditions must have a Pa.D or consider expense in an appropriate technical beld. Some appointments may be confirmed prior to August 1943 we early applications are encouraged. All qualified applications will receive consideration without regard in race, color, religion, see, or national course. Application Deadline for September Appointments. August 1, 1984. For further indomination and application busins connect SCEFE, 1101 Masterlangers. Against 6, 1984. For further independent of the part of the par phone (305) 892 6116. SCFFE supports Equal Opportunity Affirmance.

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Space Plasma Theoretician/Princeton University. A postdor total position is available beginning summer of 1984 in the Theoretical Division of the summer of 1984 in the Theoretical Division of the Plasma Physics Laboratory, Princeton University, for one year with the possibility of renewal for a second year. Physicists with a Ph.D. degree or its equivalent or other relevant discipline are encouraged to apply. The position involves theoretical and numerical simulation studies on space plasma physics under the support of the National Science Foundation, Interaction with the members of the Laboratory engaged in tusion plasma physics to encouraged. Interested candidates should send a resume and three betters of recommendation to: Dr. 11, Okanda, Plasma Physics Laboratory, Princeton University, Princeton, NJ 08714. versity, Francion, NJ 08514. Princion University is an equal opportunity/affir-

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geochemistry.

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graduate audent research, and conduct a strong research program in marine geology and stuble isotopes with emphasis on paleoccanography and palleuclimatology. Send resume and names of three
references by April 15 1984 to:
G. Ross Heath, Dean, College of Oceanography
Oregon State University, Corvallis, Oregon 97331
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Imponent Carl F. Nording

The waters of the Orinoco, Atthepo and disputare rivers, at their crincident confluence at San Pernando, are markedly different in their chemical cospection, as while as in their suspended sodiment concentrations. According to Sololie classification of South American river waters, they fit into the cleat, black and white water rivers, respectively.

A quantitative study was undertaken to measure the lateral string of those waters, at their rising stags, June 15-19, 1983. Heasurements were called at cross sections, one at each river mouth and 4 along the rain atom of the Orinoco, downstream from the ounfluence, samples were taken at 1 points on each of the 7 cross sections. Water, at each sampling location, was taken eith an integrating hotels, from the surface to one mater above the bottom. Surface temperature, pil and confuctivity were measured at the fluid sites, and all-straintly. No_mitrogen, total dismolved phosphorus, dismolved organic carbon and Suspenied mediumnts (162 and 162 up) concentrations were determined at the

Inhoratory.
Discharge and geometry of the channel had a marked
effect on the mixing rate of the 3 river waters. Transverse mixing was slow and the results of the measuraments and analyses of auspended sediments, alkalinity,
total dissolved pheaphorus, No,-natrogen, conductivity,
dissolved organic carbon, pH and tempstature in a

dissolved organic carbon, pH and temperature it is decreasing order of importance as indicators for differentiating the water masses; show that up until approximately 100 Km below their confluence, just above where the Vichade Fiver come in, the Orinoca, Albapso and Guaviere waters had not yet fully mised.

Reduced Trace Games under Low Unygon Conditions in the Veter Column of Seanich Inlet, British Columbia

M. A. de Angelia, J. A. Barosa, B. D. Lillay (all at College of Ocoanography, Proges State University, Corvellia, OR 97331)

The California Coastal Current Program

PLUTCHAK, MOEL B. and <u>ROBERT J TAIT</u>(Raytheon (5126 Ralaton St. Ventura, Ca. 90099)

Influence of Hydrothernal Emissions on Environment in Santorini and Milos Islands (Cyclodes, Greeco)

nerkounding motorial. For example, in comparison to the unaltered rocks, fitty and K are siways deple-ted, whereas metals such as Cu or Hs are utree ce-licing.

NTUROCEOLOGIC STUDIES IN THE SOUTHWEST PACIFIC: PRECIMINARY RESULTS OF DSDP LEG 92

The tracific Riss at 1903. Spreament ages of the

d. N. VALETTE-SILVER (C.N.R.S.-Volversite de Perpignan, 66000 France, and Carnegle Institution

Hielitagtun, V.B.A.)

Ocean Sciences

0113-125

Postdoctoral Position/University of Washington.
Research Associate (postdoctoral) with background in physical oceanography or atmospheric
sciences and interests in dynamical aspects of dimate variability. Term of appointment: one (1) year,
renewable for a second year subject to the approval
of the Conneil, Chring date: March 15, 1981, Send
curriculum vitae and a list of low (4) references to
Director, HSAO, (5) Department of Armospheric Director, JISAO, c/o Department of Atmospheric Sciences, AK-40. University of Washington, Scattle, An equal opportunity/affirmative action employ-

ity/affirmative action employer.

POSITIONS WANTED

Mineralogist Geochemist. 31. Dipl., Ph.D., German, US permanent-tesldent, visa, Lunar (impact, igneous tooks) and terrestrial, (sedimentation, metamorphous tooks) petrographical geochemical/geochemology, broad analytical experience (includes MS, INAA), research experience in US, English/French, fluent, impressive publication record, seeks employment in research, industry or publishing business, no geographical restrictions. Please contact: Dr. Reimold, Inst. I. Mineralogy, Corrensstr. 24, D. 4400 Munster, FRG.

STUDENT OPPORTUNITIES

Opportunity for Graduate Study in Igneous Petrology/Isotope Geochemistry—Southern Methodist University. The Department of Gerdogical Sciences at Southern Methodist University in Dallas, Texas seeks outstanding individuals interested in a PhD payment in Interest. program in igneous petrology and/or isotope geo-chemistry. The successful applicant should have a strong background in geology, chemistry, and math-ematics and an interest in volcanic processes. Research will involve participation in a held-oriented petrological, geochemical, and isotopic study of Late Centrology volcanism in the Chilean Andes. For fur-

Or. M. A. Dungan (214) 692-2752 Department of Geological Sciences Southern Methodist University Dallas, Texas 75275.

<u>Meetinas</u>

1983 AGU Fall Meeting Report

In only 3 days the AGU 1983 Fall Meeting re San Francisco accommodated more than 3460 attendees and more than 2100 papers. Each of the special all I mon sessions attractestermals of close to 1400 persons. Exceptfor the 1982 Lall Meeting, which covered 8 class and included the American Society of Lumidagy and Occanography (ASLO) Win-ter Meeting, 1983s was the largest AGU Edi-Meeting exer-

The large number of presentations at the 1983 meeting was bandled efficiently by assizong more than 30% of the papers to poster sessions, who h were no many participants the highlight of the receting Poster presentanotes are becoming extremely good, and some of the more spirited sessions make many oralpresentations seem pale in comparison. The eight of some of the world's leading geophysicosts charting over a poster paper with a sudent artested to one of the advantages of this

type of presentation. If you missed this meeting, plan early to atresult the 1984 Fall Meeting, December 3-7, which will again include the ASLO Winter Meeting It will be held in San Francisco at the Casic Authorium.

Changes to the 1983 AGU Fall Meeting program and additional, late, and revised abstrasts are printed below.

Papers Not Presented

3741-06, T. Scully, A12-13, C. Gauesh et al.: A12-14, W. H. Beasley et al., A51-04, D. H. Stedman and C. A. Caotrell, A51-05, D. G. Torr and M. R. 15011, A51 509, R. F. Shetter et al.: A52-11, S. A. McKeen,

G42-09. J. H. Karl, G51-13, R. E. Ziegler GPH-02, O. Ozdemr: GPH-11, J. L. Ros; GPH-03, D. M. Bubenik; GP41-06, F.

K. Grammelmann and D. L. Lin HI2 01, P. M. Walls, 1122A-13, F. H. Weibezahn: H31C-04, A. Mantoglon and L. Johnson.

W. Gelhar; H34C-09, T. W. Schrauf and D. D. Evany, H34C-12, A. D. Russell and E. G. Lappala: H31D-07, G. P. Kemp and J. T. Wells, H52A-02, C. L. Carnaban; H52B-04, C. Helson and E. F. Wood.

O11B-07, A. Huver: O11B-17, P. Flament et al.; O12B-15, J. M. Luck and K. K. Turekam, O21B-07, F. C. Fiedler; O22-15, N. G. S. Freeman; O31B-17, W. B. Owens and B. A. Warren: O31B-18, D. B. Boudra: O31B-22. J. N. Moum and T. R. Osborn; O31B-24. M. S. McCartney, O31B-27, S. L. Bennett et al.; O31B-31, D. L. Evans; O31B-33, G. Reverdin and M. Cane; O31B-34, T. B. McCord et al.; O31B-35, W. K. Melville and R. J. Rapp: O31B-36, D. B. Altman; O41-04, J. N. Smith and K. M. Ellis: O42-14, J. F. T. Sam and W. B. White: O528-07, C. C. Ebbes-

meyer eral.: O52B-10, K. A. Potocki et al. P32-05, L. W. Esposito; P32-14, F. A. Kruse; P42-14, M. D. Bjorkman.

S11A-14, W. L. Elbworth et al.: S11A-15, C. Vita-Finzi and G. C. P. King; \$11B-28, D. S. Cavit et al.; \$12B-02, S. P. Morris et al.; \$21 A-01, J. A. Collins et al.; \$31-08, S. Gamoe and M. Fehler; \$32B-04, M. Y. Song: S42A-03, G. Suarez and O. J. Perez; S42A-

09. L. R. Kaval. SA21A-02, S. Matsushita et al.; SA21A-05, M. O. Chaudler and G. R. Chappell; SA21A-12, C. Hannise and J. P. Villain; SA31-02, M. A. Biondi and D. P. Sipler; SA32-10, D. A. Gell et al.; SA42-04, A. I. F. Stewart; SA51-06, J. G. McConnell et al.; SA51-07, R. E. Daniell, Jr. and D. J. Strickland; \$A52-12, 11. . Fahr et al.

SC11-07, D. Moses et al. SM11B-03, B. Hausler et al.; SM12A-05, L. R. Lyons and D. S. Evans; SM12A-15, D. R. Parsgnault et al.; SM-HC-01, J. V. Olson; SM42A-01, J. L. Horwitz et al.; SM42A-06, D. W. Datlowe et al.; SM51E-37, R. W. Spiro

SS22-08, J. V. Hollweg and B. Roberts. T22A-01, A. T. Linde et al.; T22A-05, R. B. Grannell et al.: T41C-21, B. C. Haintson Y. Lee; T41C-32, J. Thorne and R. Bell: 141C-33, M. F. Coffin and P. D. Rabinowitz: 142A-08, L. S. Cluft: 142C-07, B.

V11B-06, D. A. Sverjensky, V21B-03, R. K. O'Nions and E. R. Oxburgh; V21B-08, D. T. Ghaliremani and P. O. Banks; V22B-07, R. Zhang; V31A-09, J. D. Friedman; V31B-02, G. Ivarsson: V31B-07, P. J. Kopydłowski; V31B-13, J. Helgason; V32A-11, B. R. Julian and S. A. Sipkin; V41-02, R. B. Waitt, Jr. and N. S. Macleod; V41-05, T. C. Pierson and K. M. Scott; V41-06, R. L. Dinehart; V42A-38, T. H. Pearce; V54B-13, M. S. Weathers et al.: V52B-09, J. D. Morris.

Late and Revised Abstracts

Atmospheric Sciences A12-23 POSTER

Er-wire Almospheric Potential Measurements at 1.5

J. MOGSLEY 2. HOLIMONIH (both at Geophysics Frogram, Univer-sity of Washington, Seattle, WA 98195)

Salty of Washington, Seattle, WA 98195)

Continuous Atmospheric Potential seasurements with the Ny-ware tethered balloom system have been cade for duration of -% bours at 1.5 km attitude and -28 hours at 1.1 km. 1-hour averages of the 1.5 km data compare favorably to the Carnegie curve. The 1.1 km data show a similar diurnal patters with seasuhal greater veriation from the mean. Furthermore, a clear sleattle field variation with slittude is seen above a few hundred meters. Charge-disoberge time constant measurements indicate that the Ny-wire source impedence is on the order of a few times [0¹⁰ n et both altitudes in agreement with earlier lower slittude measurements. A Carnegie-like pattern is shown by Hy-wire ourrent measurements in the grounded mode, which have typical values of -10 v A during the potential minimum and *20 v A during the maximum. Ground-based E-field measurements with a field mill show so enhanced E-field in the violation of the apparatus in agreement with a simple electrostatic model of the wire.

Geodesy

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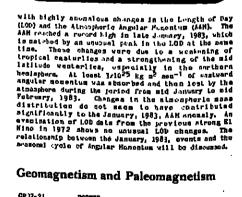
The 1932-59 EL Ming and the Earth Retailion

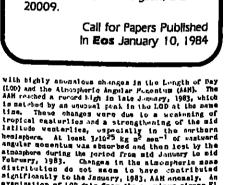
T. H. Estarka n. C. Pernjulat

R. C. Perapulat
J. O. Mirkoy
J. A. Tatepolati at Jet Projutation Laboratory, California Institute of Technology, Paradona, CA 91109
R. P. Poese, D. A. Malatoin, Atmospheric and Prefroncental Processes, Inc., Castridge, Hamachusetta

The 1982-83 El Mino was observed by wide approved changes in the studespheric and cocamic circulation, The students oscillation index, a servere of the intensity of the 61 Mino, crached record loss in January, 1983. The partial between the approved the Mino, and Mino, crached record loss in January, 1983, is also unposited

AGU President James A. Van Allon (left) prosente (c.6), 1983 Waher H. Bucher Medal to John W. Hamili, 1985





of induction Appeals on the West Coast of



ABSTRACT DEADLINE:

February 22, 1984 For more information or to be placed on a special mailing list, write to 1984 Spring Meeting, AGU, 2000 Florida Avenue, N.W., Washington, DC

CP 32-21 CRUBTAL HAGNETIC ARMALIES IN CAMADA

J. AMEANI-HAMED, W.E.S. URQUHART, D.W. STRANGMAY, (Department of Geology, University of Toronto)

The crustel scalar magnetic anomaly map of Camada and the northern United States deduced from MALSAY data is downward continued to 5 km altitude. The encesiles have no obvious correlation with tectonic provinces, but they do appear to correspond with certain types of sedimentary basins. Busins passociated with old hot apots and intercontinental rifts have positive encesiles, whereas those in the centre of cratons have beganized anomalies. Modern hot spots and mountain ranges also have negative magnetic anomalies.

J.G. Gupta, R.D. Furtz and P.A. Canfield (Division of Saismalogy and Uncommention) Early Physics Branch, Ottowa, Cangula, FtA 073) (Spontor: G.G.R. Duchbinder:

The Recommended data collected during the International Regnetodyhoric shody (1883) interval between 1936-1930 as the Canadian Stations located along the Churchill array are used to compute the trapper functions to investigate the conductivity structure in the region. The trapper and the survey of the conductivity structure suggest that an easi-west transition errors that conductor passed polyees. Natural conductor and obtion. Healthyle, The intending the survey of the conductor with the North Agning childed to the Ridge of the Conductor with the North Agning childed to the Ridge conductor.

four drilling areas were approxicately 28.5 Ma, 17 Ma, 18.5 Ma, and 4.5 Ma. The andicents at those wites ware declarably nanofossil ooses with varying proportions of iron oxide-rich clay most of which is probably hydrobarasi in origin. The base of such sediment section contains chalks which are not of hydrothernic origin. Pros waters showed no evidence of present-day hydrothernia advection through the sadiments. The aldust site, 397, was re-entered and drilling almost into bastreat with 522 recovery. The basels were reduced in the bastreat with 522 recovery. The basels were reduced in the bastreat with 522 recovery. The basels were reduced in the bastreat with 522 recovery. The basels were reduced in the secondary of the second Trace Cases in the Blanco Trough and on the Gorda Fidee When you want fast advertising results, you want Eos. Eos delivers. Every Tuesday of every week Eos is read by

SPR: Aeronomy

SPR: Cosmic Rays

Chaptvations of the 5-M Asymmetry of Solar Place ESP Events by the 195-7 and 6 after

p.c. rp:ch:UTSUS. <u>E.T. BAPPIS</u>. G.C. ANAGNIST(POIL:S |Greatries Univ.Of Tarace, Marthl.Greate) | B.M. FRINIJIS (APL/JH), Leurel, MOI

Heridian, The observed meanwetry and its implication on the dominant processes for the queenston of the solar

SPR: Magnetospheric Physics

inclications of Steady State Particle Entry for the AMERI Program

y, p. 01808 (McDonnell Dougins Astronautica Company, Munimaton Boach, CA 92647 E. A. FFITZER (McDonnell Dougins Astronautica Cimpuny, Huntington Beach, CA 92647)

Studies using remitatic magnetic fluid models have shown that KeV particles can unter the magnetosphere even when it is magnetically closed. This form of charged particle entry proceeds at all times and influences many steady histe magneto-sphere processes. This entry mechanism is present because when magnetosphere impossible impossible in the magnetosphere, they encounter a gradient in the magnetosphere in the interest opening. Their subsequent motion in such a structured suggestic field silver some of these to permanently enter the magnetosphere. Scause of the symmetry

result announcement motion of them to permanently enter the magnetophere. Because of the dymatry of the magnetophere magnetic field, the flux of entering particles is zero slong the mone-sidnight particles in zero slong the mone-sidnight particles provides the flux of the magnetopeuse and sign occurs in the dayside copyregions. This entry hodel suggests that the AMPTE release near the autoclar point will place the tracer form here the region of minimum entry. As the least move through the shock and are disported the least move through the shock and are disported.

the ichs move through the shock and are dispersed down the dawn flank of the magnetosphere, the entry retr will increase. The motion of the ions after entry will depend on both magnetic and

M. D. Lillay, J. A. Barose and L. I. Cordon (all At College of Oceanography, Gregon State University, Corvallie, OR 97331)

The Blanco Fracture Zong which connects the Juan du Fura and Gorde Ridges is comprised of nurserous trought with the largeget and deepest being the Blanco Trough (44° 20°M, 130° 0°M).

Vertical profiles of 0, N-nutrients, (N, N, and N,0 were taken in the Bilanco Trough in Jun6, 1909, Compared to concentrations at shallar depting at a gration received to the ridge-trough area (30°M, 145°M).

U, was reduced by approximately one-helf within the trough saciety very near bottom where it was undetectable. M, concentrations were similar at buth shittons. The reduced gases and nurrients all aboved considerable vertical atructure in near bottom sumples allinin the trough.

The trough active in mar button unique along and the trough. A settles of near button hydrocaste water also fall during a general survey for hydrotheraal activity in the Gorde Hidge in August, 1980. One of these stations (42° 00°M, 17° 00°M) ethinted Cit. concentrations on order of magnitude shows the 'collect duep value in the lower 400 naters, indicating that the cast may have been in the vicinity of an artive vent.

042-02 REVISED

Argon 39: The first deep profile! (Continued....) H.CRAIG, K.XDM (Scripps Institution of Oceanography, UKSS, La Jolle, CA 92093).
H.H. LOOSLI, U. WEIDMAN, P. KALT (University of Bero, CM-3012 Barn, Switzerland).

Corvalits, OR 97331)

The reduced gases, N., Gi., CO and N.O. as well as 0., Nn.O., NO., NN., Nn.A. ATP and designification potential (activism biochage technique) were consured throughout the water column of Samich index, stitled Columbia in October, 1982, and in February, April, August and Soptember, 1983. Sampling was concentrated in the tid-water column where low O. (20 ml conflictions prevailed. A high degree of "variability in the reduced trace gas and nitrogen spacies concentrations was conserved in this region and is believed to reflect outrible production/consupption machanisms for them games and nutrions. Correlations were observed among N. onales (5.7 to 18.1 att, high dentitification potentials (12) to 181 maxims N.O./I./day and ATP maxims (20.1 to 489 pt). Additionally, the coincidence of H., and Coincidence (5.5 to 80 pt) H., o. 1 to 27.0 at CO. as ins. (5.5 to 80 pt) H., o. 1 to 27.0 at CO. as ins. (5.5 to 80 pt) H., o. 1 to 27.0 at CO. as ins. (5.5 to 80 pt) H., o. 1 to 27.0 at CO. as ins. (5.5 to 18.0 pt) H. to 55 at NH, ON, max 50 the passation consumption satisfacts involving the maximal transpectively. The data subject that the maximal-was regulating the theriton of thems gases and nitrogen martinate in Nomichi inlet ray by controlled by 0. concentrations at low O., levels (0.2 to 20 at 0.1). Ch-1012 Barn, Softzerland).

The first depth profile for ³⁹Ar (a consic-ray produced "non-transfent" tracer, mean-life = 385 years = 31 of radiocarbon mean-life) was reported for harfaca, 250 m, and 600 o depths of the W. Pactific Greener 1 Station, two years ago (Graig, Mo, Louell, Oschger, E05 52, 312, 1981). We now have data (ale, 107 ³⁹1) at depths of 0, 150, 230, 400, 600, and 4200 m (possible more by AGU time!) Samples for each depth consist of 600 cctsTP) of Ar, estipped from 2 toms of ocean water; ultimately a 10 depth profile, representing 20 toms of water, will be completed. At 600 m the ³⁹Ar activity is 403 of "modern' defined as atmospheric and surface water activity). At 4200 m depth we observe a ³⁰Ar activity = 172 of modern fish counting rate/sample here is 0.021 of that for radiocation measurements, which gives an idea of the effort involved). The ¹⁵C Thang age largeomential decay time) for this water is 1340 years, which gives a yead-total of the third transportation of the complete of the continuous of the complete of the comp Under the spunsorship of Bureau of International Hanagement Service, an extensive profile saverements in the coastel waters of ser California (Foint Conception to San Frances) is beginning in November 1983.

Measurement components are: 1) Time varies and direct pressure, temperature and conductivity at mocatics selected to best capture the flow pathindicated by the results of historical atual These have characterized the large scale feet of the region as a number of flow region as a number of flow region as a number of flow region at the service of the service of the coast at intervals along the coff of the one of the coast at intervals along the coff of the and extending offshore to about 70 Za)Continuous current profiles along hydrographic tracks using a ship mounted dop acoustle metar. 3) Near-symptic and extending of the surface (100 feet ASL) wind and temperafields and the surface redding vater temperafields.

Modeling Storm-Oriven Currents in the Santa Barbara Channel R. S. Gordon (Erron Production Research Co., Houston, Tx 77001)

the response of the Santa Barbara Channel to storm winds was investigated using a Leo-dimensional (x-z), two-layer numerical model. The model has a surface dixed-layer that entrains according to a velocity dependent parameterization, and a lower layer in which the density varies linearly with depth.

or the surface (100 feet ASL) wind and tempers fields and the surface rediint water tempers over a limited geographic area in the vicinit Point Conception during the hydrogramaceauments in that area. 4) Asrially ma Lagrangian motion along the hydrographic 1 during the time of hydrographic work and sla the locations of pertinent small scale aur motions about to exist by matallite imagery. The passage of a storm that occurred in February, 1959, was simulated in detail in order to illustrate the highly non-linear response resulting from large displacements of the thermocline and from the entrainment process. For this storm, estimates of the long-shorm berstropic pressure gradient were available from Calculations conducted at the University of California, Santa Barbara, using a three-dimensional model covering a large section of the California Shelf surrounding the Channel. Historical and ancilliary data from other sou in the region will be collected into the data for guidance in the amapling design and comparison with the or-going resulta. particular winds from the coastal sites, one and offshore will be analyzed for their influon shifts in the current atructure. An advisory committee and workshops will convened to guide the progress.

In this simulation, it was necessary to increase the depth of the nearshows grid calls in order to grount the thermocline from intersecting the bottom. The effect of this artificial deepening was estimated qualitatively by using Camady's linear constal jet theory for a channel with arbitrary depth variations.

Because the entrainment rate is such a highly non-linear function of the mixed-layer depth and the valocity difference between layers, the sensitivity of the com-puted solution to uncertainties in the initial and forcing conditions and to grid resolution and horizontal eddy viscosity was investigated. The chemistry of five her aprings situated on islands from the Cyclades were studied. They are leaded un lend or at eac, on the betton of bays or fractures on Sanctrian-Mes Kasson i Starms and Moyalloy. Hilms (Thelerisain and Marrugramma) and bisales (Thermopairs). The chemistry of the aprings shows the strong participation of seawater in the hydrichronal filled. Compared to standard see whist, but M. and 510; are always in excess in the aprings with Fe/Ma ratios varying from 5 to 10. At in interface between hydrothronal filled and see water, hirosa procipitation occurs. The new saterial formed is previous another the surplus of the representation of animater, roths and modiments surrounding the most of the lett apring depend movily on the pill and excitery of the herotherwest field. For example, on Milos in the Medicalcois Mot Spring, the pilled heritation of the Call 8) and the vaters untibit the highest concentrations of dissolved for and Mn of the five springs studied. The codiments surrounding the vertex also were rich to Mn, with the copyanis where the pill of comparison to the contrary in Sanctriat, where the pill of combanion is higher than 3. The maximum of the pilled that the surrounding the vertex surfain, where the pill of combanion is higher than 3. The maximum of the first pilled the surface of the surface of the contrary in Sanctriat, where the pill of combanion is higher than 3. The maximum of the first pilled the comparison to the conflict of the matter scalestate.

Seismology

Selseic Recordings Containing Frequencies in the Audio Fange F. CRAMSWICK (U.S. Geological Survey, 345 Midlefield Road, Menlo Park, CA: 94025)

Road, Penilo Park, CA. 94023)

Frequencies as high as 100 dz are present in the spissopries of recent afterprocks of the January 9, 1982 Miramichi, Res Bruswick carthquake. Both Sources and receivers of these seismopraes recorded in July 1983 are located within the boundary of a granitic pluton that underlies the aftershock zone. This high frequency phenomends was observed at ranges of less frequency phenomends was observed at ranges of less than 10 hm at 1st different stations all of shich were equipped with three-component 2 hg velocity transducerns situd directly on basement outcrop and recorded by CAOS digital seismographs sampling each component at 400 digital seismographs sampling each component at 400 digital seismographs sampling each component at 400 hgs. Some records show resonances at about 50 Ng and 100 Nz on the vertical and horizontal components for exercisely. These high frequencies are absent in respectively. These high frequencies are absent in records made with identical instrumentation at a site at which the transducer was separated from the natework digital records sampled at 100 ms per channel digital records sampled at 100 ms per channel recorded at a seventh hard-rock site shows a high requencies. I have a high requencies indicates that the exposed crystalline rocks are characterized by low anniastic attenuation. This observation is in action with, the reports of sounds associated with actional components surgests that be exposed crystalline rocks are characterized by horizontal components surgests that be exposed crystalline rocks are characterized hydrogeneous distributions of the frequencies indecated with actional digital in northeastery lights and that of the frequencies interact with same small scale (tant of metars) structures such as exfoliation joints within the outcrops.

M. LEINEN, (Graduate School of Gecanography, University of Rhodo Island, Karragansett, RI 02882-197)
D.E. REA (Department of Atmosphorte and Occasic Scionce, University of Machigan, Ann Arbor, KI 48109
LEG 92 SHIFRDARD SUIDHTIFIC PARTY Leg 92 completed suitidisciplinary hydrogeologic Studies of sevon sires in the Pacific to massine the controls on past and present hydrothermal processes. Six may sites, Sites 597-502, were delited in four areas which form an E-V trapment on the west flank of

ole, this finds it out are. It is expected that the most likely pair of a find if a too into offer entry will now of the first out of the most the fear tall region of the most of the first likely the pair to specie. The finds the first likely the fall may in the color the species. The finds the major where the fall may in the color of the fall may in the color of the species of the color of t

chapel Hill. N.C. 27541

Array determined azimuth of approach, ... values for telescively ovents occurring at distances esceeding 90' agree facurably with values predicted by the new codel for lower mantle heterogenetty determined by this month (1981). Agreecent was noted for two large arrays located in the wostern U.S., ASSA and Hanford. Predicted 4 anomalies calculated using the Diseworki model agree in sign and relative angultude with 5 amounties calculated for LASA for nine out of ten globally distributed ray paths. LASA 6 unumalies are always larger in absolute angultude but this is to be expected as the Giseworki model produces a low pass filtered .iew of the volucity perturbations insugrement is greatest for ray paths originating in continuous manualles as allational near array lower mantle structure is needed to explain the LASA and lanford anomalies associated with this source region. The continuous associated with this source region. The continuous content content agracement between LASA and predicted according suggests that illinious.

In the definition of the LASA stray diagrap. francist set on of Athabas, lower topour's the Aspell's Super spring. 1. G. 156 and t. S. MAN theophysical all Institutes, Policyments, of Markey, Patrioghe, Markey 1994. The Path regards we make the regard are self-the Hilbert taken HILD threath the extend one of the extending the self-the extending of the extending the exte

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A. Powell (Department of Geology, BNC-Chapel Hill), Chapel Hill, N.C. 275141

process of the spheric control of the set of

According to the transfer of the control of the Pro-charge of principles to the control of the control of the Proceedings of the open proportions of the transfer of the control of the digits and a selection of the Control of the control of the open of the control of the principles of the control of the c

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Tectonophysics

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Meetings (cont. on p. 58)

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More than 3000 persons attended the 1983 AGU Fall Meeting in San

Francisco. Shown are some of them at the registration booth.

57

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Meetings (cont. from p. 17)

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Volcanology, Petrology, and Geochemistry

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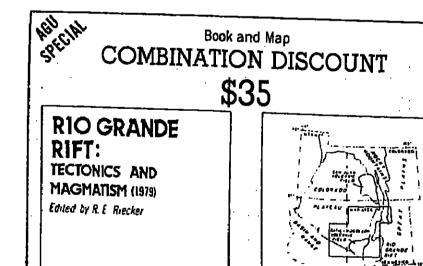
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> Geologic map of the Rio Grande Rift and Southeastern Colorado

Plateau, New Mexico, and Arizon

(1983) by W. S. Baldidge, Y. Barlov, and A. Kron

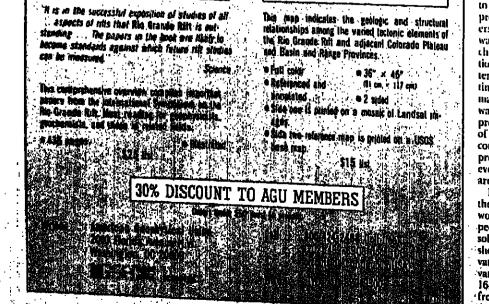
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H is in the successful exposition of studies of all espects of ritis that Rio Grando Ritt is out standing. The papers in the book one likely to become standards against which feture till studies can be measured.

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The Ata pyroclastic flow deposit is one of large-scale pyroclastic flow deposits erupted 30,000 - 60,000 years ago. The eruption was started with small-scale pintan air fall, local minor pyroclastic flow and succeeded by the climas eruption of the Ata pyroclastic flow. The deposit is densally welded, even in case of a thin deposit. The deposit shows a symmetrical distribution within a valley channel or a hasin. Such a structure was mand depositional reams. in case or a time deposit. The deposit shows a asymmetrical distribution within a vailey channel or a besin. Such a structure was named depositional ramps (i) and recognized in a wide vailey or basin whose width is more than I km. Height difference between the highest and the lowest points of a single depositional ramps is larger in wider vailey. Ramping directions show this radial directions away from the source. Scale of depositional ramps decreases with increase of distance from the source. This structure is regarded to be formed by the excellent accumulation of pyroclastic materials in a windward-side rather than a lee-side within a vailey or basin. Dip angle of the original surface is assumed within 4°, which is similar to the repose angle of large-scale pyroclastic flow deposits previously described. The same structures were also recognized in other two densely waided pyroclastic flow deposits based on published geologic map and topographic map. But this structure is difficult to find in a non-welded pyroclastic flow deposit. This suggests that high emplacement temperature is helpful to form depositional ramps.

Depositional ramps of the Ata pyroclastic flow deposit in southwestern Japan

<u>X.SUZUKI</u> and T.U! (Department of Earth Sciences, Faculty of Science, Nobe University, Mada, Kobo

(1) Suzuki, K. and UI, T. (1982) Geology, 10, 429-432. ¥323-20 POP, (FE

Checked and Lectopic Composition of Case Diablo Not Spring: Magmatic Co, Mear Mammoth Lakes, CA

B. E. TAYLOR (Department of Goology, University of Cailfornia, Davis, CA 93016) T. M. GENLACH (Sandia National Laboratories, Albuquarque, MM 8/185)

Albuquerque, AT 871851

Combined chusical and isotopic analysis of fugarolic games collected at the Case Diable Not Springs (bolling: 95-97°C) near Magaoth Likea, CA, indicate that magnetic CO₂ is presently reaching the surface here. Fifteen wepor-phase samples were collected in 11/82, 1/83, and 4/83 using a thereality insulated cube inserted a meter into the fugarole, and evacuated sampling vensuls containing alkaline solutions. This technique procluded condensation and direct attospheric contamination during sampling, the latter indicated by low levels of N₂ (C 0.03) sule t) and 0, + AT (f 0.75 moler pps). Complete chamical analysis of the samples yielded an average composition (in mole I) of 69.4 N₂1, 0.5 CO₂, and 0.01 to 0.04 total S (mainly and N₃21) NCL, IIF, O) and hydrocarbons other than Chamer below detection limits. N₂ and CN₂ did not exceed molar pps levels.

were below detection limits. He and Clg did not exceed molar per levels.

Carbon imptone analysis of separated Co-indicated Alf values of -5.59 and -5.68 /oo. There Alfales are within the range of compositions of Ch., from fluid inclusions in igneous rocks (arantite pagastites; baselts) and of primary igneous carbonates. The concentration and leocopic composition of the Gass Diablo Co., together with the absence of hydrocarbons in the gasses and the paucity of licestone in the subsurface, excludes non-magnatic sources as the principal origin for the Co..

These data suggest: (1) Co. is expolving from magna hearsth Chas Right), and [2] monitoring the relative Co./N.O ratio of the functoric gases might prove useful to svaluate subsurface governments of ranges.

Assessing Nuclear Explosions

The all-Union session on the Geophysical and Geochemical Consequences of Nuclear Explosions at the 1983 AGU Full Meeting attracted a large audience, and many were unable to find a seat or standing room. The speakers and questioners emphasized the complexity of the processes and the need to extend the computer models. In particular, the global-circulation models presented by scientists from the National Center for Atmospheric Research showed that smoke/dust clouds should cause major changes in the weather systems with great contrast between the temperature perturbations over oceanic, coastal, and continental regions. Important developments in the models and conclusions can be expected over the next few years as AGU members from many disciplines contribute their skills. On behalf of the Public Affairs Committee, I want to thank all the speakers at San Francisco for their excellent presentation on a difficult subject.

This meeting report was prepared by Joseph V. Smith, who is with the Department of the Geophysical Sciences, University of Chicago, Chicago, IL

Latin American Geomagnetism Workshop

Modelers of the earth's magnetic field look to the network of magnetic observatories to provide information on secular change. Others, studying the shorter period variations, want the observatories to provide digital, machine-readable data. Whatever the application, whether it be the data base for the International Geomagnetic Reference Field, time extrapolation for satellite surveys, or magnetospheric current studies, all users want more from the observatories than is presently available, especially from that part of the world composed largely of developing countries. Money might solve some of the problem, but it is generally unavailable. However, there are other factors, some of which

are more amenable to solution. In an attempt to improve the data base, there has been proposed a series of regional workshops, bringing together the operations people and the users to discuss problems and solutions. The first of these was the Worksliop on Latin American Geomagnetic Observatory and Survey Practice held at the Observatorio Nacional in Rio de Janeiro, October 16-22, 1983. There were 45 participants from 15 countries of Latin America, North America, and Europe. The stated objective

was to improve the quality of the Latin American geomagnetic programs by informing the participants of the state of the art in the various areas of geomagnetic work; dis-cussing common problems and their solutions; promoting information exchange by personal contact among the participants; providing information which might assist in strengthening the bases of national programs; and encouraging participation in in-

ternational programs. The following topics were covered: observatory operations, field surveys, magnetic instruments, field modeling, magnetic cartography, uses of magnetic data, and national and international programs. There were formal papers and round tables; papers were delivered bilingually, in English and Spanish or Portuguese, Several important needs became apparent during the proceedings. These were put in the form of resolutions, including the encouragement of geomagnetic research on regional phemomena; periodic checks of observatory standards against the International Magnetic Standard; the desirability of digital recording; improvement in opportunities for training and exchange of personnel and information; and closer collaboration with IAGA and the World Data centers.

Positive steps were taken by participants to ward establishing new observatories in some of the data gap areas. All agreed it would be appropriate to have another workshop in 5-10 years.

This workshop was sponsored jointly by the Sociedade Brasileira de Geofísica, the Observatório Nacional, the Pan American Institute of Geography and History, the Inter American Geodetic Survey, the Instituto Geofisico del Perú, World Data Center "A" in Boulder, Colo., and the International Association of Geomagnetism and Aeronomy, Co-organizers were J. S. Lourenco of the Brazilian society, L. M. Barreto of the Observatorio Nacional M. Casaverde of the Peruvian institute, and K. L. Svendsen, representing World Data Center "A".

The Observatorio Nacional is planning to publish transactions of the workshop. Papers will be in the language of original presentation and abstracts will be available in at least English and Spanish, Distribution will be to the attendees, to those Latin Americans who were invited but could not attend, and to magnetic observatory operators throughout the world. Inquiries may be directed to L. M. Barreto, Director, Observatorio Nacional, Rua General Bruce No. 586, São Cristóvão, 2092 l Rio de Janeiro, Brazil.

This meeting report was contributed by K.L. Svendsen, who is with World Data Center A. Boulder, C0 80303.

Actions at Hamburg

International Association of Seismology and Physics of the Earth's Interiors

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Commission on Wave Propagation in Real Media S. Crampin (UK) European Seismological Commission H.

UNESCO/IASPEI Working Group on a Code of Practice for Earthquake Prediction

In recent years, a number of earthquake predictions have been made, both by individual scientists and by institutions, some of which have proved successful and have been followed by action which has resulted in the saving of human life and the reduction of material losses. Others have been unsuccessful but their publication has led to serious disrup-

tion of economic and social activity in the areas at-

fected by the predictions.

The successful prediction of earthquakes is an anportant scientific objective, and research in this field should be actively encouraged, but it is clear that scientists who are engaged in such research, and who find themselves in a position to make medic tions, must bear an unusual degree of social respon-

Ill-considered release of a prediction to the public main may have grave social consequences; on the other hand, a successful prediction may be instrumental in saving many lives but only if it leads to appropriate and well-organized response by the community concerned.

Following an agreement reached between UNFS-CO and IASPEL, a Working Group on a Code of Practice for Earthquake Prediction mer in Hamburg August 12–18, 1985, A list of the participants appears at the end of this report.

Given the wide variety of social structures within which research on earthquake prediction is conducted in various countries, the task of defining a Code of Practice having universal validity is one which will require wider study. In drafting this code, how ever, the meeting regarded its task not as one of defining a code of ethics, but rather of recommen guidelines for the more effective formulation, evaluation and communication of earthquake predictions for the benefit of society.

Code of Practice for Earthquake Prediction

The objectives of this code of practice are as fol-

1. To ensure that scientific earthquake predictions are put forth in such a way as to favor constructive

social response.

2. To encourage seismologists to undertake re-search in the broad held relevant to seismogenesis and earthquake prediction.

3. To assist the development of earthquake pre-diction as a means both of testing hypotheses of seismogenesis and of mitigating earthquake risk. 4. To prevent scientific predictions being conlused in the public mind with predictions not based on aclentific observation and reasoning.

5. To promote international cooperation and goodwill in the area of earthquake prediction. Formulation of Predictions

Considering that research of earthquake precor sors is now progressing from the stage of data od lection towards the stage of hypothesis-testing, it is recommended that predictions be formulated in terms of probability, i.e., the expectation, in the space-time-magnitude domain, of the occurrence of an earthquake. The strength of the predictive state-

ment is then represented by the increase in the expectation, compared with that prevailing before the ediction was made.

As a prediction develops in the course of continu ous monitoring of the region, the expectation may be progressively modified on the basis of further precursory data or other relevant occurrences, so that the prediction process itself becomes continu our. Likewise the performance of the hypothesis can be continuously reassessed. The region being monitored will in general include areas of reduced expectation as well as areas of increased expectation. and the prediction as a whole can, if appropriate, be readily adopted as a basis for designing or modilying earthquake countermeasures in the region.

Scientific Evaluation of Predictions

Earthquake predictions need to have adequate support from within the seismological community before being considered acceptable as a lastic for the formulation of warnings. Scientists should therefore seek to have predictions confidentially reviewed by their scientific colleagues and should ensure that such support is forthcoming before making them more widely known.

In countries where organizations have been set up or designated for the purpose of the scientific exil-uation of predictions, scientists who wish to put for ward predictions should submit them to the relevant organization. Scientific editors who are considering the publica-

tion of papers containing earthquake predictions should take special precautions to ensure that alequate support from within the seismological com-umnity has been obtained for these predictions.

Communication to the Public and Public Authorities

Experience has shown that disorganized and counterproductive public response may arise from the direct communication of an earthquake predution to the news media. The news media are generally not the appropriate means by which to an-nounce a prediction. The author of a prediction should instead communicate the prediction contidentially to the governmental authority designated or bestable to deal with such predictions.

At all times, scientists should exercise extreme care and restraint in communicating directly with the news media since the matter potentially affects the salery and socioeconomic stability of the popula from in the designated area.

Predictions Concerning Foreign Countries Recognizing the serious problems that may arise

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from the prediction by scientists in one contrivid an earthquake that may affect another country, it is recommended that.

1 Originating scientists and scientific editors should give careful consideration to the potential social and political effects of a prediction concerns

ing a foreign compry. Every effort should be made to involve actenfists of the affected country or region cooperatively in the prediction effort and in the evaluation of spe-

3. Appropriate scientists and governmental officials of the uffected country should be advised of the prediction effort at the earliest opportunity, should be kept informed of the continuing regard and should be notified of the results sufficiently in advance of their public release to allow for response by the affected government.

Recommendations for Further Action

1. Considering that not all countries have earthmended that UNESCO, in collaboration with IA-SPF1, establish an international carthquake prediction evaluation panel or rester of experts which. upon request, will be available to assist any country in the evaluation ofearthquake predictions.

2 Recognizing that scientists in one country may need to communicate predictions to appropriate au thorities in another country, it is recommended that UNESCO request each member state to designate an authority to receive earthquake predictions onanating from other countries and to take any appro-

3. Recognizing the importance of objectivity, re-producibility, and rehability of preductions it is recminended that UNFSCO and TASPET be requested to convene workshops on algorithms for earthprediction and evaluation

 Recognizing the importance of recent applica-tions of probability theory and exploratory data analysis to the formulation and evaluation of earth-quake predictions, it is recommended that UNISCO. and TASPET be requested to convene an international meeting on this subject.

5. Since earthquake predictions will be effective in reducing human and material losses only if they are followed by appropriate concerts diaction to reduce culnerability in the affected areas, it is recommend ed that UNESCO and UNDRO undertake widetailed study of the problems arising in the response to long, medium, and short term carthquake predictions by rivil defense and other televant orga-

Meeting Participants

C. R. Allen (USA): F. Evison (New Zealand), F. M. Fourmer d'Albe (L'Ennee), A. Guesecke M. (Peru). V. L. Kedis-Borok (USSR), C. Lonnoitz (Mexico), G. Mader (USA); 1. Rikitake (Japan). Nu Shao Nie (China), For UNES(O) M. Hashizume (France).

Announcements

Women Engineers and Scientists

The Baltimore-Washington section of the Society of Women Engineers will host the 1984 International Conference of Women Engineers and Scientists in Washington, D.C., lane 17-24, with women from more than 30 countries expected to attend and participate in technical and professional seminars.

The theme for the conference will be "Technology—An International Bridge." Among the topics will be transportation, education, agriculture, computers, communications, energy, and medicine. Professional development sessions will also be held, focusing on the problems facing women in technical fields, the fulfillment of career goals through continued education, and management versus technical careers. For more information, contact Rosemary Markle, 9122 Battle St., Mamassas, VA 22110; telephone 703-642-6035.

Groundwater Quality

The Second International Conference on Groundwater Quality Research, sponsored by the National Center for Groundwater Research and the U.S. Environmental Protection Agency, is scheduled for March 27: 29 in Pulsa, Okla. The emphasis of the conference. will be on the physical, chemical, and biological processes that control the movement and fate of contaminants in the substituce. Papers have already been selected on topics tucluding investigative methodology, biological and nonbiological transformations, sorption. and transport processes

Early registration for the conference closes March 1, For further information, contact Norman Durham of Ann Redells, University Center for Water Research, Ollahoma State University, 203 Whitehurst, Sollwater, OK. 71078, telephone 105-621-6995

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Electromagnetics

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Mad. Sci., Paper 450186

0720 Electromagnetic Theory
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usin Exploration Geophysics (Maynetic and electrical methods)
GROUND MAGNETIC SURVEY IN THE COSO RANGE, CALIFORNIA Glenn R. Roynewore (Pewdaren Doyartenet, haral Mantons Conter, China Lake, California, 19355)
A ground magnetic study was completed in the Irsu volcanic field 70 investigate faulting and associated mydrothermal alteration patterns. The respectic mydrothermal alteration patterns. The respectic intensity contours raten general grounds patterns in intensity contours raten grounds. The respecting fault zones have up as strong cannetic form that form a triangular-ranged area. This area is contend in an area of nighest heat flue and is a site contend in an area of nighest heat flue and is a site function field the coolination of high heat flow of content field the coolination of high heat flow function along faults suggest that he, it fluid filled fractures with nigh permandility evists. [Raynelics, mydrother, Res. B. Paper 181762] Hinh Alan II Chave Hustitute of Geophysics and Planetary Physics, University of Cultionia at San Diego. La Jolla CA 920911

The Fréchet derivatives of the fundamental toroidal and poloidal magnetic modeling are estimated in detail. The response functions for both modes are shown to be Fréchet differentiable. response functions for both modes are shown to be Fréchet differentiable in un L₁ norm for general conductivity structures and orbitary source frequency-wavenumber morphology. Perturbation furms of the model Green functions are demeed and used to available the Fréchet kernels for a vesifior controlled source and a Kelvin wave model in both case, the TM mode possesses suprior residution ushib, especially for loss relative conductivity confuents at depth. The results suggest that induction by the secon index can see details of the interophetic structure at depths of at least 50 km. Infectiomagnetic induction theory, inverse theory, bricking dariatorial. entantel 1. Geophys. Pon., E. Paure Abrill

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Exploration Geophysics

USIN Exploration Geophysics (Maynetic and electrical

of the earth is a potential field in this case, and using well-established patential field theory, it is known to be possible to predict the reapones of both horizontal components on any plane from a complete knowledge of the certical edge near to the base classifier required operation to acopyled not the established to the established of established of the established of established of the of the earth is a potential field in this case, and

12.1 mm) from high sittinde through near, cloud conditions, can be used to delineate the sealise sign, locate polynyss and leads, nearure lee concentration, determine tee type, age and iniciness and to quantify the sea surface with and struspheric properties. In the leads of the sealing struspheric conditions. The location, movement and concentration of the sealine edge greatly affects the dynamics of the-ecean circulation and air—sea interection. This information is fundamental for accurate long-tern weather prejiction and for ship operations. These are the first ossurements of sea ice ever obtained at 18 and 220 GHz, infilimeter ware radiometry, maginal ice zone, all-weather).

Pad. Sci., Paper Asolal.

0910 Selvaic methods
SOUND SPEED AND ATTERNATION HEASUREMENTS IN CASSY
SEDIMENTS IN THE CULF OF MEXICO
Thomas B. Edrington (Sandis Merional Laboratorian,
Exploratory Systems Division 1627, F.G. Box 5800,
Liboquerqua, M. 47185)
The appeal and attenuation of sound in gasay marinu
sadispote is the Mississippi delta arms have been
measured by means of small (i to 500 mg) explosive
charges buried 10 m below the mud line. The respective

charges boried 30 m below the mod live. The respective values obtained were 800 m/sec and 1.4 d3/kHz-s Rffective gas content was estimated to be approximate.

Octob persons of the more reported by the service of the mature of Scientific Reflections from DEEP CRUSTAL FAULT (CRES TETT, D. Jones and Amos Mar (Sack Physics Project, Department of Scophysics, Stanford University, Stanford, California 94305)

Deep selsmic reflection profiles have recorded reflections from ductile shear zones within the crystalline basement. Ferhaps the best example is the COCORP Wind River line in Myoning, which shows the Yind River thous fault to be a strong reflector from the surface to depths of about 30 bilometers. To identify the physical properties responsible for the selsmic reflections from fault zones we report measurements of compressional wave velocity and destroation of plastic minerals, brittle deformation of the more rigid minerals, prain size reduction, and development of a strong fabric. Amorage velocity and density were not found to change significantly and systematically between the mylonites and the adjacent undeformed rock. So simile anisotropy of 71 or greater to present in suveral mylonites and the adjacent undeformed rock. So simile anisotropy of 21 or greater to present in suveral mylonites and the adjacent undeformed rock. So simile anisotropy of 12 or greater to present in suveral mylonites and the adjacent undeformed rock. So simile anisotropy of the cocord the compare them to two and thuse plots of the COCORP Wind River reflection date. When enisotropy and the finely laminated structure of the fault zone is considered, our modeling ladicates fairly strong reflections from mylonite zones in must cases. Me also show that elevated poor pressure in shear zones may produce strong reflections. However, a permanistive on the order of 10 Total Carry is required to maintain sufficient pure pressure to produce a velocity anomaly in a fault zone which has lengthen inactive. (Kylonites, Sejant Velocity, Sejant Permanisters I. J. Langton Description of the cocord inactive. (Kylonites, Sejant Velocit

fractures with high permeability exists. [Maynetter, hydrothermal, faults, furarules).

J. Geophys. Res., 8, Paper 181762

E OSO Magnetic and electrical methods
SURRY DESIGN The MULTICORPORET ELECTROMAGENTIC SYSTEM

SURRY DESIGN The MULTICORPORET ELECTROMAGENTIC SYSTEM

de James C. Marphe (Department of Physics, University of James C. Marphe (Department of Physics, University, State state sections from the size state of sections formation, Toronto, Ont., Ganda Mil 147; and Lemantagus Totusto, Toronto, Ont., Ganda Mil 147; and Lemantagus Totusto, Toronto, Ont., Ganda Mil 147; and Lemantagus States in the same of parameter. States and the same of parameter. States are common sidpoint gather at the name of parameter. Mil 153 173)

A raving coil receiver is employed by survey modern

A raving coil receiver is employed by survey spatial be EM exploration systems to measure various spatial common midpoint states unjoy the practical advantages of midpoint coordinates. In médicion, the instance of the magnetic field components of the time derivative of the magnetic field components of the time derivative of the magnetic field components of the time derivative. The absolute set up by a fixed trassmitter. The absolute instant aucous accordancy field agasured above the surface instant of sections accordinates. A section is considered to common midpoint gathers. Rowavar, common sidpoint gathers. Rowavar, common sidpoint gathers and survey of the practical advantages of midpoint coordinates. In médicion, the instant aucous accordancy field agasured above the surface instant accordance accordance in the surface of the surface instant accordance in the surface of the surface instant accordance in the surface in

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theoretical disideanings is that there is no exact treatment of lateral pelocity variations. Sient stack adjustion is a period of "adjustion before atom." It polves the dip selectivity problem of stack." It solves the dip selectivity problem of conventional stacking, particularly when horisuntal reflectors intersect steep dipping reflectors. The correct hadding of all dips also improve lateral resolution is the large. Stant stack signation provides a straighforward method of measuring interval velocity after signation has improved the migration called translating translation for also accurate for posterities reflections and refrections. Thus sevents transfers into a pet surface with the additional discussion of midpoint. The signat stack migration equation converts the pet surface into a deprivation of valcity surface. As with migration in general, the effects of dip are automatically accounted for during velocity inversion. Georgeological, Vol. 44, No. 3

0930 Selemic methods
TRAVELTIME LEVERSION OF OPPSET VERTICAL RESENCE
PROPILES—A PRASISLICIT STUDY
L.R. Lines (Amoo Production Resents Contar, P.O. Box
1991, Tules, OR 751023 A. Bourgedis, and J.D. Coway
Travellime from an offset vertical science profile
tVSPJ are used to estimate subsurface two-disensional
dip by applying an iterative least-equares inverse
method. Teste on synthetic data demonstrate that invariant techniques are capable of satisficing dips in the vicinity of a wellbose by wing the gravultimes of the vicinity of a wellbore by using the traultimes of the direct arrivals and the primary reflections. The inversion method involves a "layer stripping" approach in which the dipe of the shallow layers are estimated before proceeding to estimate deeper dipe. Examples demonatrate that the primary reflections become

4.5

essential whosever the vallo of source offset to layer depth becomes small. Travelties inversion also requires careful estimation of layer valuables and proper

Geochemistry

1410 Chemistry of the Atrosphogo backstan recommence Calculations for Createstant of the Month Carpeds
Line Blancy (Allica Corporation,
20 Fout-sty St., Buffalo, 26 14210) and

Million J. Hill

A rather-blody is described for combining current information on order pertubitions estimated from the second of the second o (of no transferred, ogose chamical radal J. brighten, Sons, D. Saper 400-95.

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SELECTION AND A COURSE CONTRACTOR OF COLUMN ASSESSMENT Transfer from the subsect of the property of the formation of the first the star was a superior of the

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The transfer of the state of th 140 Terbelgons 1901/1401(17) OF Le-Co STETEMATICS TO PLANETARY 540(1) Sample Manaturns, Mercanidas Inframento, and Comment E. Londig (E.S. Limblegtes) Surveys, Wideful Graturs, Day 2000, 180 May. Danners, Goldensch William Craturs, Day 2000, 180 May. Danners, Goldensch William Commentariam of Comment Large Comments of Comments

isotopic tracer to goological processes. Owing to the lew abundances of 170 kg and 1.0 c in mature, our measurements of 180 kg/40c ratios of natural eastless have relatively large 100.0213 perfores, and the variations in Ce-instope ratios were barely resolved. A tensous saticorrelation was observed between Co, and by for terrestrial baselts and greates, Indicating that with some improvement in smallytical techniques the Co isotopic composition may prove useful as a tracer for geological processes. A very low Co, predicted from the Ca smooth yin the NEZ pattern of the Robbar L3 chendrite (Makesura and Resuda, 1971) was not observed in this study. Reside, 1973) was not observed in this study, indicating that the Co anosity may be caused by regrestrial containstion or alteration. A low represertal contamination or alteration. A low settmated for the source of Sakhla is consistent our previous estimate (Nakaours et al., 1982) of a LBER depleted source. (Co isotopes, La-Co, Co

1899 Miscellanous (to's Surface)
2805208 AND MODIFICATION OF SO, ICE BY ION BONGABREENT
OF THE SUPFACE OF TO.

R.E. Johnson, J.N. Gerrett, J.W. Boring, L.A. Earton
(Engineering Fayelca, University of Virginia,
Charlotteswille, Va. 27901), W.I. Brown (Bell
Lohe, Murray Hill, N.J. 07974)
We report measurements of total yields, energy
spectra and mass spectra of molecules sputtared
from 50; ice at low temperatures by keV Ar Iose.
These measurements are applicable to corotating
sulfur and oxygan ion sputtering of 50, on lo. Va
find that the yields are much larger than those
extinated earlier for low energy ion sputtering of 50,
and the energy spectra are packed at lower energies
than espected. We observed the irradiacion time
dependence of the chemical atternation of frush 50,
leading to the production of new molecular species
and lefentify measure 12 fG, or 5), 48 (50), and
50 (50, or 5,0) as ejected species in addition to
50;. These measurements are used to determine the
rate of direct sputter ejection of sulfur into the
Jovian plasma torus, the tate of stosion of patches
of 50; cr., and estimates of the surface column
densities of 50; in 50, ice produced by the corotating
and fast lows. We setimate that the direct sputter
ejection rate of justice to the Jovian plasma is of and fast time. We estimate that the direct sputter ejection rate of sulfur to the Jovian plasma is of the order of 10¹ stems/es, that the arcaion rate of from 50, deposite due to sputtering is of the order of 10⁻¹ calyser, and that only for peactrating to behaviour can a significant, and pushing behaviour can a significant, and pushing behaviour column density of 50₃ be ptoduced in an SUs front

J. Gaophys. Res., S. Paper 385121

Geomagnetism and Paleomagnetism

297) General (Ophiolite Magnetic Properties)
MAGNETIC PROPERTIES OF THE BAY OF ISLANDS OPHIOLITE
CUITE AND INCLICATIONS FOR THE MAGNETIZATION OF
OCEANIC CRUST B. Ann Swift (U.S. Geological Survey, Woods Hole, MA, 023433, H. Paul Jongon
Fack Eignette properties, opsque mineralogy, and
degree of setsmorphism were determined for 101 First Engratio properties, opsque mineralogy, and degree of metamorphism were determined for 101 unreferried complets from the North Arm and Biow-Me-Down minife of the Bay of Islands ophicitie complet, Medicundiand. The weathered and metamorphosed extrusive bestit supples have a weak, secondary magnetisation arising from oxidation and evaluation of lieusite of usenum origin. The initial magnetisation of the underlying sheeted disc complex appears to have been destroyed by hydrothereal situration soon after formation. The cognetic intensity of the geobodic samples increases as the degree of alteration increases, with the highly altered upper metageboro having an average intensity of 3 x 10⁻³ er/cc. Because expectication of the catageboro samples in related to nonpervasive, variable alteration, those crutal units are unlikely to make a significant contribution to limested segmetic anomalies. A capitation of our results and other studies suggests a model in which counted-orast augnetication results from a toper service basis course layer reacquistic from these Bay of Islands data. Here of the description of the counter of the service of the counter of the cou sagretization). 1. Gr. (5.4. Mes., B. Paper 48090)

The control of the properties of the control of the alcretarras, tustinirs, Alambas. J. ce pipia, Pag., B. Paper "BOIAS

the Second Impossic properties of minerals) commonly waterprivation of a reagonaterier resentation in the fleehitt-specific cultin solution course, C.s. Legen (Feen 19-1/9888-100, Mouston, II. 1988). Cal. Sec.

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Hydrology

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Subject title AND STORTED RESPOSE TO CLEARCH
RANGES AND RIFE PEPARATIVE IN THE UNACHITA HOUSTAI
E. L. Willer (forms) Pydrologisk, Southern Parenty
Research Contes, Myschaeuser Company, Rot Springs,
Abbeauss, 1900).

nacearch Contest, toyetherouser Company, Not. Springs, Arranas, 1901).

Clourcat harvest and hits preparation, which tackeds receiving the residual vegetation, broadcan burning ded content ripping, were usplied to three mail universabled to Oblahoma. Three undisturbed friested esterabels served an evaluate First year pedicent ledees avaraged 282 and 15 kg/he from the alestent ledees avaraged 282 and 15 kg/he from the alestent shall control watersabed respectively. Freelmans differenced to nedizent pinds were usignificant the second and third years but not the fourth year following treatment of the foreity year following treatment and the part of the study: Stord-out yield from clearcut and control untersheds were residently loved it years following brantaneah antiqued 27-9 and 11.7 to no chartest and control untersheds respectively. The lower seater yield on cut untersheds respectively in the principle withing this from challent untersheds the standing with yield from challent untersheds the passed gardent watersheds the passed gardent watersheds the problement. The overall impact of harvest had shid proper at the point of the principle.

Geomagnetism and Aeronomy Volume 23. Number 1

Charakhehyan A. N., Charakhehyan T. N. Zonal modulation of cosmic rays and the general magnotic field of the Sun Ivanov K. G., Mikerina N. V., Klurshiladze A. F. The time of an isolated shock

cesses of transport in solar wind.

Mineov Yu. V., Spir'kova E. S., Shestopalov I. P. Recurrent streams of electrons with energies of 0.03-3 MoV and their spectra by the data of the ASE eProg-

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Rezuvaov O. I., Sheshukov S. S. Horizontal redistribution of lonospheric ions un-

Rezuveev O. I., Sheshukov S. S. Horizontal redistribution of ionospheric ions under the influence of longitudinal currents

Liu Van Liong. Procession of ionospheric data by order statistics and the dependence of ionospheric parameters on the solar activity

Tushentzova I. A., Tzedilina E. E. Multifrequential model analysis of the conditions of short waves propagation at the trase Nikolaev—Havanne

Tverskoy B. A. About radiant forms of aurorues

Dublinin E. M., Zakharov A. V., Pisarenko N. F., Lundin R., Hultqvist B. Observations of accelerated ionospheric ions at auroral force lines at (3—6) R.

Darchleva L. A., Ivanova T. A., Kovrigina L. M., Sosnovetz E. N., Tverskaya L. V.

Diagnostics of the magnetosphere state by the data on the solar cosmic rays

Diagnostics of the magnetosphero state by the data on the solar cosmic rays spalor P. A., Wagner C. U., Grafe A., Trakhtengeriz Y. Yu. About formation of a gap in the electron component of radiation belts.

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solar cycle . Gershenzon N. J. About recovery of parameters of ring current by variations of the geomognetic field on the Earth ... inversal time in variations of structures

of the mugnetospheric convection and polar ionosphere.

Gul'ielmi A. V., Zolotukhina N. A. Estimation of the size of the region of proton injection by the data lpdp injection by the data lpdp Gravin V. O., karasik A. M. About the spectrum of energy density of the ocean magnetic anomaly sources with irregular spreading Braginsky S. I. About short-periodical geomagnetic secular variations Zagnyi G. F. The nature of regional 500—600 year variations of the geomagnetic Blednov V. A. The choice of algorythms when reulizing the modul method of de-

fining the magnetic field components

Ben'kova N. P., Bondar T. N., Kolomiitseva G. I., Cherevko T. N. Presentation of the main geomagnetic field and its secular variations by the model

Brief informations

Ivanev K. G. The magnetic axis of the bipolar group and the speed of interplanetary plasma . Papitashvili V. O., Gromova L. I. Variety of the interplanetary magnetic field in the cycle of solar activity
Pereyaslova N. K., Pokrevsky P. E., Stozhkov Yu. I. Dependence of chemical com-

Pereyaslova N. K., Pokrevsky P. E., Stozhkov Yu. I. Dependence of chemical composition of galactic cosmic rays on the general magnetic field of the Sun by the data of stratospheric measurements
Pakhomov S. V., Gorbanov A. N. Profiles n. (h) of D-region of ionosphere of the equatorial zone, measured in the period of solar activity maximum
Borlsov N. D., Zolotarev I. P. Influence of the ionospheric skin-effect on excitation of Alfven waves during the periodical heating of the ionosphere
Zhiltzov A. Y. A possibility of prolongation of time of work of one-jump SW radiolines in the presence of gradioms of I_nF2
Yukhmatov B. V. To the theory of radiowave capture in the ionospheric channel during the multiple scattering

Akishin A. I., Akimenko S. V. A double probe of a high potential in a rarefield plasmin . Gveleciania A. L. Kurzkhalia E. G. About field of speeds of the largescaled wind

Sergeeva N. G. Observation of radioaurora in the day casp Yuzhenko O. T. Twilight emission H₂O+ near 6700 A. Matveeva O. A. The spectrum of twilight emission H₂O+ near 6700 A. Sobolev V. G. Spectrophotometering of twilight emission H₂O+ near 6170 A. Pisarsky V. Yu., Rudneva N. M., Fel'dshtein Ya. I. Highspeed solar wind — a necessary condition of geometrophic disturbances. cassary condition of geomagnotic disturbances

Pudovkin M. I. Shukhtina M. A. The role of reconnection processes in generation of electric fields in the magnetosphoric tail
Pisarsky V. Yu., Rudneva N. M., Fel'dshtein Ya. I. Energetic characteristics of solor wind and intensity of goomagnetic disturbances

Nazaretz V. P., Sergeev V. A. Dependence of frequence of appearance of P12 pul-

sations on parameters of noar-Earth modium

Barinov G. I., Babkin E. V. Magnetic anizotropy of solid solution γ-Fo₂O₃ — Fe₃O₄ Letters to the editorial board

Grigorov N. L. On the origin of the electrons in the environment of Saturn . .

reall and short-lived. (Silviculture, watersheds, peak flow, euspended wollds). Mater Pesour, Res., Paper 341994

Ji25 Glaciology (Ice core analyses)
TROPICAL GLACIERS: PUTENTIAL FOR ICE CORE
PALEOCLIMATIC RECONSTRUCTIONS
L. G. Thompson (Institute of Foler Studius, Ohio State
University, Columba, Ohio 43210), E. Mosiny-Thomson,
P. M. Grootes, K. Pourchet, S. Hastagrath
The potential of tropical glaciums and ice caps for
the reconstruction of past climatic conditions by the
analysis of line and tes cares is evaluated. Samplos
from pits and cores retrieved on three snaw fields in
the South American Andes are compared with results from
Ice bedius in East Africa and Indonesis. Heasurements
include the discaparticle concentration. ice bodies in East Africa and Indonesia. Measuramenta include the discrepatible concentration, expan include the discrepatible concentration, expan include abundance ratios, and total buts radioactivity. The Queiccays ice Cap contains the bost preserved annual signal for all three parameters. Berlier work buggested that so ice core to bedrock should contain a fewer of 600 to 100 years. This inference was continued by drilling to bedrock in 1983. The Queiccays ice Cap on the usatorn odgs of the Peruvian Andes has a region to the usatorn odgs of the Peruvian Andes has region to the usatorn odgs of the Peruvian Andes has region of South America. (Micrograticions Within the traject of South America. (Micrograticions, El Niño, at Agon Estopus). J. harriya. Res., C. Piper 400091

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DIJO Groundwater
FRALMATION OF THE SKIN EFFECT IN BLUG TESTS
Charles R. Faust and Impos W. Mercer (GeoTrans, Inc.
100 Fiden Street Meradon, Virginia 22070)
Bydraulic properties for low-permeability formations
are often estimated using sing tests. If the well in
which that tests are conducted was drilled with drilling
fluid containing mud, them formation damage may have
accurred. Buch damage may result in sing test interpresention that yield estimates for hydraulic properties
that are representative of the damaged rone, as uppused
to the furmation iraelf.
Water Resour. Res. Pages 19701 Water Resour. Res., Paper 3W2001

3130 Groundwater
OPTIMAL ANNUAL OPERATION OF A COASTAL AQUIFER
U. Shamir (Faculty of Civil Engineering, Tachnion Israel Institute of Technology, Maifa, Israel)
J. Bear and A. Gamilel
Optimal annual operation of a coestel aquifer is
determined by using a multiple objective linear
programming model, based on a multi-cell model of
the aquifer and a network representation of the
hydraulic distribution system. The decision variables are pumping and/or recharge quantities in
each cell. Four objective functions are based on!
(1) a desired groundwater surface map. (2) a desiables are pumping annual sections are based unsech cell. Four objective functions are based un(1) a desired groundwater surface map, (2) a desired location of the sea water-fresh water interface
toe in each crastal cell, (3) a desired concentration map of a selected conservative contaminant,
and (4) minimization of the energy for pumping and
each results.

and (4) minimization of the energy for pumping and recharge.
An approximate linearized expression for the location of the interface has been developed, to enable the use of linear programming as the optimization method.
A trade-od,
A trade-od,
The model is applied to a segment of the coastal aquifer in largel - a 44 km strip along the coast with a width of 7 to 15km - and results are discussed.

sed. Mater Resour, Res., Papet 3W1990 1140 Limnology (irradiance Distribution)
A METHOD FOR COMPARING SCALAP TERRODANCE MEASUREMENTS
WITH UPWARD AND COMMAND IRRADIANCE (N LANCE
P.M. Spidgal Digbt. Civil Engineering, University of
Cantarbury, Christohurch 1, New Yasaland) and C. HowardWilliams

Miliams.

A method is obtained for competing measurements of scales trradiance, as measured with a colon trradiance as measured with a colon trradiance, as measured with a colon-derivation of the plate irradiance where is simply in based upon an agridual formulation of the asymptotic gridings distribution given by Jellov (1976). Species are observed with measurements, in asymptotic gridings distribution given by Jellov (1976). Species are observed with measurements, in asymptotic griding radiation; irradiants; add agreement. (Lakes, species Raghur, Res.), Papar although

1170 Snow and ice
1NSOLATION TOPOCLUMATES AND POTENTIAL ABLATION IN
ALPINE SNEW ACCURDILATION BASINS: FFONT PANCE, COLORADO
G. A. Olyphant (fleelogy Papartmost, Indiana University,
Blaomington, Indiana, 47405)
Radiarion data from the Institute of Arctic and
Alpine Research, high siritude climatological station
are used as input to a maserical model for computing
insolation to rugged terrain. Simulated insolation
topoclimates for an average (partly cloudy) surror day
differ markedly from those that occur on a frare)
clear summer day. On a clear day, insolation is
grountest in south facing hasine and least in basins
that face north. Sur on a partly cloudy day, sear
facing basins receive the largest daily insolation
totals whit onerth and south facing basine receive
mentically aquivalent amounts. An analysis of the
correlation between rediction mail equivalent and
measured glacier ablation muggeers that computations
of reddation melt should be based upon average diurnal
trajectories of solar transmission if reasonable rajectories of solar transplasion if reasonable stimetes of potantial basic welt are to be achieved for alpino areas. (cirque insolation, glacier ablation, computer simulation). Wetor Resour. Res., Paper 440022

3170 Snow and 1ce AN OVERVIEW OF PASSIVE MICROWAVE SNOW RESEARCH AND

AN OVERVIEW OF PASSIVE MICROWAVE SNOW RESEARCH AND RESULTS
J. L. Foster (Hydrological Sciences Branch, Code 924, Goddard Space Fiight Canter, Greenbelt, Maryland, 20771), O. K. Hall, A. T. C. Chang and A. Rango The current state of inowhedge of the microwave properties of snow is discussed. Theory behind the microwave emission from snow is reviewed as are the physical processes of snowpack metamorphism. Field, aircraft and satellite passive microwave data have been acquired and analyzed for more than 10 years. Results have repeatedly demonstrated the fessibility of amploying multifrequency passive microwave data to study snow-covered area, snow depth and internal snowpact properties. Radiation amanating from the ground beneath a snowpack is scattered by the snow crystals and concurrently the snow itself emits radiation at microwave frequencies. Thus, the radiation at microwave frequencies. Thus, the radiation amerging from the snowpack is the result of a complex series of interactions both within and beneath the snowpack. Future studies recommended by a snowpack properties morking group consisting of government and university scientists are discussed in detail. Recommendations include performing extensive laboratory measurements using real and artificial snow to be coordinated with theoretical modeling and aircraft overflights carrying passive microwave instrumentation. This is considered necessary in order to help to interpret the microwave responses to snow. (Passive microwave, snowpack, remote sensing).

Ray Goophys Space Pays. Paper 480995 lav. Geophys. Space Phys., Paper 480095

11.75 Soil Mointure THE OPERATIONAL SIGNIFICANCE OF THE CONTINUUM HYPOTHE-SIS IN THE THEORY OF MATER MONYMENT THROUGH 90119 AND

AQUIFERS Philippe Baveye (Department of Soil and Environmental Sciences, University of California, Riverside, Call-Sciences, University of California, Riverside, California, 935:1) and Garrison Nposito. The appealinnal measing of the Representative Elementary Volume (REV) concept, on which current loundational theories of water novement through person readia are based, is analyzed critically. It is concluded that the REV concept as applied to real person rusia is both unnecessarily restrictive and experimentally smeerifiable. In its place, a relativist capear, is reconstituted to which retressed the substitute of the place of the proposed to which retressed to the place of the proposed to the proposed to the proposed to the place of t mantativ unvertitable. In the place, a relativistic concept is proposed to which macroscopt, blooked variables are defined as convolution products of microscopic properties of a persua neiting with weighting functions that represent the appropriate massuring imprements. The effects of resolution and precision differences among experiental measuring devices, now recognized as critical in the accessoral of spatial variability in the properties of selfs and equifors, can be incorporated naturally within the relativist concept, but are excluded a priori in the PV concept, how a clear operational measuring and extends themestical variability in principle to all local measurements made on procus media. It is welfacted themestically to during conventional macroscopic halones equations for mass and linear momentum, as well as a differential equation for the inschematical transport of water through an unsaturated, anisotropic deformable soil or equifor. (Cronodetter flow, self-star confilibria, see, leater momentum, apartially). concept is proposed to which macroscopic phostics Water Postur. Ros., Paper 3W1992

Meteorology

010 Boundary Invariation and processes PASSPORT OF OLOUE BY DEBULEWE AND CLOUDS IN AN CRAS DOUBDARY (AVER C. F. Greenbut (MOAA/ER) (R/R2), 325 Brondwar, Boulder, Colorado 80301, J. F. S. Ching, R. Peurson, Fr. and T. F. Repoff The turbulant fluves of nations and latent and

ir, and T. P. Pepoff
The turbulunt fluwer of oxone and latent and sensible had are computed from functorizations.

Consumments made abound a NOAA aircraft over down-town following his national and evening of 22 August 1979. In the aircraft throughout the prognout of 200 m is downard throughout the prognout of the largust manifulds (-2 (ppb) m m⁻¹) occurring over the urban center. During the afternoon at both 200 m and a few loundred neture below cloud laws, the horizontal profile of mean ozone concentration peaks at 130 ppb over the urban corne with values of the order of 90 ppb to the southeast and morthwest. The urban ozone concentration peaks at 100 ppb over the urban corne with values of the order of 90 ppb to the southeast and morthwest. The urban ozone concentration at 200 m decreases to 35 ppb be early coming. The normalized variances and directra of vertical velocity, temperature and expectation in the urban center and northwest suburbs during the afternoon, in good agreecent with normalized statistic chained over rural terrain. But from a cloud penetration by the rural terrain. Data from a cloud penetration by sircraft is used to estimate a mean updiraft velocity of 4,0 % and an updraft area of approximately 1 km. The flux of exone due to the mean mution in J. Goophys. Res., D. Paper 400184

3715 (heroical Composition and Chemical Interactions, Metagrology NON-METHANE HYDROCARBONS IN REMOTE TROPICAL, CONTINENTAL, AND MARINE ATMOSPHERES
J. P. Greenberg (National Center for Atmospheric Research*, Boulder, Lolorado 80307) and P. R.

Atmospheric hydrocarbon measurements from remote areas are presented and analyzed to determine sources of ambient mixing ratios. Blomass burning appears to make major contributions to free tropospheric hydrocarbon burden over tropical forests and grasslands longenic emissions constitute a large percentage of the almospheric than a large percentage of the almospheric constitute of large percentage of the large percentage percentage of the large percentage percent output contributions to free tropospheric hydrocarbon burden over tropical forests and presistands. Biogenic entstions constitute a large percentage of the atmospheric hydrocarbon volume in continental ereas of significant productivity. In marine areas studied, ambient hydrocarbons may include contributions from evaporation of dissolved hydrocarbons tremsported by ocean currents from areas of coastal upwellings or marine pollution. In all cases, hydrocarbons from local sources are major components of the atmospheric hydrocarbon composition. (Hydrocarbons, continental, marine, tropics).

The difference between the summer and winter observations are not solely due to changes in photochemistry but require consideration of stratospherit dynamics. We correlate the reduction in NO, in winter with the production of N₁O; in regions of little or no insolation followed by transport to Cold Luke. The unusual profiles are shown to result from air masses at different slittudes having sither different origins, e.g. polar or mid-latitude or different transit times from the mource to the sampling point. (Mitrogen oxides, seasonsi distribution, stratospheric chamintry).

J. deophys. Ros., D. Paper 480089

3720 Climatology THE ORIGIN AND EMPLIEST STATE OF THE EARTH'S HOROGRAPH J. Grahm Cogley (Geography Dopartment, Trant University, Potentiorough, Ontario, CANAN FSJ 782) and A. Henderson-Sollers
The origin and earliest history of the Earth's ydrosphero - the excess volutiles define) by Ruboy in 1951 - can be constrained by evidence from astrophysics and quology. Abdels for the evolution of the Solar System and for the growth coolution of the Solar System and for the growth of the Earth suspeat quite strongly that the hydrogener cane into boing during acrotion. Its formst, with H.O. rosely in the cocane, CO. mostly in sediments off to residual attraptore indimated by By. CO. and H.O. was established very carly and has permisted without destabilizing climatic corumsions. Alternative accounts of early history in which the Earth either loses a mestice primorial atmosphere or acquires its secondary atmaphere by gradual depositing, now seem improbable. It is difficult, for example, to dissipted amosphere in reasonable tires, and gradual outgeening some to be ruled out because accretion was a highly energetic process. Several geological isotop systems which can be sampled today require early suparation of the atmosphere, and probably the hydrogener on a sarrly origin of the blooghours. Coological indicators of atmospheric composition are also constants with an early hydrogener hydrogeneral indicators of atmospheric composition are also constants with an early hydrogeneral hydrogeneral indicators. Such a hydrogeneral squared destical character. Such a hydrogeneral square initial neutral or meanly remove common a character. Such a hydrosphore, samed by a luss leathern early Sun, appears to be climati-cally stable at surface temperatures close to that of the present day if the major hydro-spheric constituent is liquid when A neuspheric constituent is liquid sets; A new global occur and a clearly straighter suffice majoran stability against the perils of the "doop freeze" as the "mayoran accurate there manufathes of attractive to produce the production." "deep freeze" and the "transary decembers, large quantities of attrophete; needboard game are not repitted for elimite as delifty, although CD may sold have been percent in amounts harder than to hay have commons of dry are, however, difficult to a contracte in the picture which we present, but the continent probabily did not different into an ill later in probabiled lineary. Irealized placer for my have provided a militer factoriable for early changed evolution.

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interpretations 1. Geophia Heat, D. Piper authori

3790 Instruments and Techniques HIRBUS-EARTH RADIATION SUBJECT SENSOR CHARACTERIZATION FOR HIR WILLD DATA FEBRUARE FIDELITY CHARACTERICATION FOR INFOLD DATA FLOWING.
FIDELITY
R. Maschhoff (Guiton Industries, Inc., 6600 Guiton Court NE, Albuquerque, IM, 87109).
A. Jalink, J. Hickey and J. Swedberg,
Decailed characterizations of fitight spare earth flux sensors from the Bimbue Earth Radiation Budget (EPB) program have been performed which, when coupled which a corrected accounting of the orbital instrument environment, provide the potential for greatly improved accuracy in the final data products. The characterizations included dotailed FOV mappings, responses to transfert long and short wavelength radiation, and response to sensor temperature changes. These sensor and environment characterizations, along with the outstanding low noise and stability properties of the ERB instrument signal processing system, promise to improvement of the data accuracy to levels sufficient for long term budget and climatological purposes. The combined data sets from Minbus 6 and 7 are unspected to spam a period in excess of 10 yeers. The improvements in data accuracy are particularly significant over zonal latitude bands because the corrections are shown to be atrongly latitude dependent. (Padlation budge sensors).
J. Geophys. Res., D. Paper 400040

179) General (Pracipitation Patterns)
SOT FEATURES OF CROUND RAIN PATTERNS MEASURED BY RADAR
IN HORTH ITALY
A. Pawhina (Centro Studi Telecorunicazioni Spatiali CAP,
Politecnico di Milano, Piazza Leonardo de Vinci 32.
2013] Milano)
The radar observations of rain during 1990 at Spino
d' Adde near Milan provided a large data bass composed
of about 15,000 ground rain calia, collected at the low
elitude of 1.5 im from the ground, and characterized by
s reflectivity factor greater than 34 dBz. Inis collectton of rain elevents supplied soce statistical information recovered for rain-attenuation modeling. Thus the
point rainfail rate distribution as well as the cumulati
we distributions of maximum, mean and rook mean square
of rain rate raferred to an individual rain area (cell)
were found to be power-law functions of the rain rate.
The probability distribution of the linear extent, D, of
a rain cell with a given rain intensity, 8, exceded over
the cell, was found to be an exponential function of D,
while the probability distribution of cells with a given
rain rate extended in the cell. The empirically derived
formula for estimating the absolute probability of a
rain cell with a given minensity and size is proposed
and found adequate for the observed region and period.
(Rain cells characteristics, rain-attenuation modeling). ine). Red. Sci., Paper 450134

Ocean currents from areas of coastal upwellings or marine pollution. In all cases, hydrocarbons from local sources are major components of the atmospheric hydrocarbon composition. (Hydrocarbons, continental, hydrocarbon composition. (Hydrocarbons, continental, hydrocarbon composition. (Hydrocarbons, continental, hydrocarbon composition. (Hydrocarbons, continental, hydrocarbon composition.)

The Mational Center for Aumospheric Research is sponsured by the Mational Science foundation.

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Atmospheric and Oceanic Physics

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Kabanov M. V., Sakerin S. M. Methods of Passive Sounding of Atmospheric Transmittance in the Atmospheric Surface Layer
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Demyshev S. G., Eremeev V. N., Ivanov L. M., Knysh V. V. Passive Scalar Trans-Grynnik V. M. Radiation of Sound by Line Vortices Elansky N. F., Glushchenko Yu. V., Gruzdev A. N., Elokhov A. S. Atmosphoric Ozono Content Measurements from Aircraft during the Solar Eclipse of 31 July 1981 Britayev A. S., Elansky N. F., Lukshin V. V., Plakhina I. N., Khalikova B. Kh. Ozone Concentration near the Earth's Surface during the Complete Solor Eclipse Potenkin V. L. Meteorological and Actinometrical Observations near Balkal during the Solar Eclipse of 31 July 1981 Kuznetsov M. N. Calculation of the Absorption by Monomer H₂O Wings in the Khrgian A. Kh. Book Boview: The Ozone Layer, Ed. by Biswas A. K. for the UN Environmental Program. Pergamon Press, 1979, 382 p.

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Gryanik V. M. Dynamics of Singular Geostrophical Vortices in a Two Level Model Posphere
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Zhidko Yu. M., Konevsky M. B., Bodin V. V. Wind Noise in Bailar Cantineter Signal Bellected from Sea Surface .

Pointkov V. G. Fedotov A. B. Nonlinear Effects in a Spectrum of Surface Gravi-Intional Waves Khrglan A. Kb. About Development of Atmospheric Ozone Investigations in India Mazin I. P. Book Review: Clouds, Their Formation, Optical Properties and Effects/Eds: P. V. Hobbs, A. Deepack (Acad. Press, 1981, 497 p.)

Physics of the Solid Earth

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Atlantic and Pacific oceans

Baraukov O. M. Fracturing and electrical resistivity of low-porosity rocks Yakovley A. P. Recording Iroe oscillations of the Earth with a laser strainmeter Zubkov S. I. On the sarthquake energy dependence of the origin time and occurrence area of a telluric field precursor rence area of a telluric field precursor I. A., Kapustyan N. K., Nikoleyev A. Y., Volodin A. A., Zelikman E. I., Dadadzhanov I. A., Kapustyan N. K., Nikoleyev A. Y., Fikhtyeva L. M. The experience of seismic sounding using the stacking of signals from an air gun Vlasov B. N., Dorofeyev I. F., Filolov V. G. A stochastic approach to the problem of potential fields separation

Oceanography

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A713 CATCOLAR ION LAWRENCE OF AN ANTICYCLANIC PING IN THE MESTERN COUF OF MEXICO
A. D. Kirvan, Jr. (Deputment of Hyrine Science).
University of South Florids, St. Fetersburg, Florida
13701), W. L. Mercell, Jr., J. R. Levis and R. E. Whiteler
This analysis documents for the first time the
property and velocity characteristics of an
anticyclonic ring. The ring was pinched att from the

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Particles and Fields— Interplanetary Space

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Sind Solar wind intersection with some and planets court winds (contration Temperatures) imprises from The court 5 years concentrally of Different particle French A.S. Calein (Ceraminant of Physics and Astronomy, University of Stayleri, Callege Bark, MD 2016), F.M. Livit b. G. Live vier, D. Sivestati, B. Flacker, and M. S. Tiev

It as b, G. then then, D. Havenlatt, B. Flanker, and H. Shiles.

The charge masse enginetism of beautitions, primarily the teach conference of the group, has been determined for tealer diffuse parafile events in the design of the market diffuse parafile events in the design of the market below. The paragraphs were made with the University of Parafamilian-Since-inside. There is no Finery (large Analyser (UZCA) sends on 1975. The velative rhings state insident on 1975. The velative rhings state insident on 1975. The velative rhings state computation that he command on a function of energy per charge. It is suggested that the charge state computation of them is relief and large what the companion in the solar state, and he is to make the expectation in the solar state, and he is to make the expectation of them is relief and the solar state. In particular, we detain average Co tenturation of them. In particular, we detain average Co tenturation which is a contract of the contract of the velocity of malar with the contract of t taigneen and (1.55/2) a 10° F for diffuse particle scattle is unriched, diving interational solar with conflictions, (1.55/2) a 10° F for exempt occurring during current his seas, the fight speed attention, and (2.55/2) a 10° F for exempt occurring during two alternations. The diffuse particle count in distinct terminations occurred to coronil holometric termination of the colorial to coronil holometric training and appeals attend as a particularly charactering, elice appeal attends are particularly described. The respect of allow of holometric countries for high speed attends are presently need to the colorial training and the colorial content of the colorial solar attends and the colorial colorial training and are consistent with a particular accounts. me:") and are consistent with equilibrium temperatures preferred for cornel toles, tipler wind indirection inspirar area, control hole temperatures, upsteam Armen Service And Control of the Service

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Particles and Fields— Ionosphere

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torperious are presented for the altitude distribu-tions of the concentration ratio between regions representing entereds of the borizontal variation. A sirgle diffusive-equilibrium redel deconstrates that the effects of ion respectature on the 6° vortical distribution are a significant factor leading to the above a stration of the concentration ratio. (ion ob ergod seriation of the concentration tatio. (to J. Craphys. Res., A. Paper 4A0181

5545 Innospheric disturbances LOGS MATPLENGTH LIMIT OF THE CURRENT CONVECTIVE J.D. Huba (Naval Pasearch Laboratory, Washington, D.C.

J.b. Hubs (Naval Passaron Laboratory, washington, 503)

A linear theory of the current convective instability in the long wavelength limit, i.e., bl. < 1 where b is the wavenumber and L is the scale length of the density inhosogeneity, to provented. A relatively simple disparation equation is derived which describes the modes in this limit. Analytical solutions are presented in both the collisional (v₁ >> w) and inertial for a limit where is the wave frequency it is shown that the grouph rate scales as b in the collisional limit and as h² in the inertial infect. The snallytical solutions are compared to exact numerical solutions and very good agrossmal is found. Applications to the survoid losseshers are discussed. J. Goophys. Res., A. Paper (A010)

UNISHVATION, POLATICA CHANNES IN THEORDSPIPPLE CHRESTINGT TO DEPTETUS IN THE PESSEN TOTAL TIME OF THE GENERAL STORM OF SEPTEMARK, 1982 M. I. Miller (Labyratory For Flametary Atmosphurea, MASH/Goddard Space Flight Counter, Greenbelt, MD 20771), H. G. Mayr, N. V. Spencor, L. H. Brace and G. R. Data taken over midletitudes by Dynamics Explorer 2

Daia taken over addititudes by Dynamics Explorer 2 during a specialistic tors are used to demonstrate that a direct correlation entages between depictions in the ratio [0]/[N] and in the topside electron duestry [N]. That currelation is most conspicuous along 40 invariant latitude where a decrease in [0]/[N] by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in N, by a factor of 1 is associated with a depletion in the factor of 1 is associated by the Mind and Twapersture Specialistic of the construction between variations in the currelation of the construction in the currelation of the construction in the currelation of the construction of the currelation of the ton repetitor controls in observed virilations of repetitor is, at the higher latitudes. Nowever, the development it 20' invariant initials of elevated gas experitures and an enhancement in 8, indicates that a store induced equations of the indicates that course induced equations at a rate that initially exceeded the rate of innitiation leaves there. (long-spheric Steres, There-ophers-planusuphers coupling) J. techine. Bess, A. Paper AADOST

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PARTITIC ACCEPTANTON TARALLEI AND EMPERORISHMENT TO
THE MODELS (FILM OBSERVED BY 05-2)

P. A. Hoolin (Spino acle), These of Tenan at Dallan,
Richardson, In France, I. B. Mininghap, M. Noglara
and No. C. Maccard

The creation is the instrument parkets on 19-2 have
been madel to study the pieces and electrodentaric properties of the Consequence when tield-aligned currents
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control and particular and Companion with incommentary and promited to the promited to the control of the proper frequency white of the radio waves been perfected from the innerpose in related to the species while of the reflecting layer through an integral equation. An algorithm is proposed to selve this equation when almostoneous measurements of the Coppier while at several frequencies are available. This persits one to recover the apparent relocity profile from Doppler abander has been built which can unprive sequentially several president of the theory, a vertical Doppler needer has been built which can unprive sequentially several president control of currently sealing to laboratory sequentially several president composed of currently sealing to laboratory sequences of currently sealing to laboratory sequences and the second of currently sealing to laboratory sequences has been performed between the Doppler results and the strain incoherent scatter data. Though obtained from a limited season of data, experimental evidence seen to support the theory. Conditions for the applicability of the mathed of discussed. (Doppler secunding, ay propagation, images of the conditions for the applicability of the mathed of the season of the mathed of the season of th

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Particles and Fields— Magnetosphere

5713 Electric Fields
EFFECTS OF OBLIQUE BOUBLE LAYERS ON SPROUNG IOW FITCH
AMGIR AND GYROPHASE
N. E. Greenspan (Johns Hopkins Daiversity, Applied
Physics Laboratory, Luurel, Maryland 20707)
Gheservations of electrostatic shocks above the
auroral sone, of uppoing ion beans which show evidence
of both parellel and perpundicular accalaration, and
of for conics soggest that the shocks play a role in
the energiation of the beams and, perhaps, of certain
conics. To investigate shock effects on ions, I
follow the trajectories of many ions through a very
simple modal of an oblique double layer, a warrow
region of strong electric field with components both
parallel and perpundicular to the magnatic field.
Acceleration through the model shilique double layer
produces gyrophase bunching, and hence density
oscillations. Although it arises from a model which
is not melf-consistent, this result shows that a
consistent oblique double layer sodel must include
temporal veristions and/or spatial oscillations in the consistent oblique double layer model must include temporal veristions and/or spatial oscilitations in the density or electric field. The oblique double layer increases both the perpendicular and the parallel energy of ions. The amount of perpendicular energization is greater for Ot than for Ht, in agreeous with observations. I stantine the parametric dependence of perpendicular energization on fulful ion energy, sugis between the electric and magnetic field, and width of the patential structure. (Flactric fields, double layers, shocks)

J. Goophys. Res., A, Paper 4AO145

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6. Bandonan (1971 far estimate Present Paper), G. Haerendel nad O.H. Pauer
6. Tarch G. 1974, long-partied telecomputate waven versical in the forgoom magnetosters by n guiden for policy (31). The places drift velocity and ungoetic field oscillations unneclated with those waves were observed by the chertman on experiment and the expendicator, respectively, emboard the GEC-2 catellity in the countries plane. The waves had both compressional and transverse economics and lad their protable nearest in a magnetic tallward travelling large-seale magnety was completed from the travelling large-seale magnety was completed from the magnetic tallward travelling large-seale magnety was completed from the companion of the form the complete countries. The satellite observations and the Double vesters estemblished from these are consistent with a teal ion of the resonance region at later through the first 5 min after the 31 while the anti-city and inside the renonance region at later through the first 5 min after the 31 while the anti-city and inside the renonance region at later through the first 5 min after the Station of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression of the expense of the Alfvén velocity due to the compression o Cirla). J. Geophym. Pos., A. Paper 4A0144

5736 Engetic tail
COMMENT ON THE OBSERVED PLASMA DENSITIES IN
JUPITER'S DISTARM HAGNETORALL (WAKE):
A POSSIBLE EFFLANATION
S. Gracdisleski (Space Research Center,
Polish Acadomy of Sciences, Ordona 21,
PL-01 237 Warsaw, Foland), W. Macek
The relatively high, Jovien tail (wake) pleama
density ~ 2 - 3 * 10 cm observed by Voyager
; at anti-sunward distances from Jupiter of
3 - 4 AU indicates that the tail cavity is
continuously supplied by solar wind pleama
leaking through the tail boundary. It is shown
that this inflow could explain the average
density monsured in the cavity if one
identifies the tail (wake) boundary with a
rotational discontinuity. The average rate of
colar wind inflow into the tail is then
described by a phenomenological parameter a
that describes the average efficiency of
reconnection. The observed value of tail pleama
density can be reproduced if the global, tail
averaged value of a that takes into account
the **indows** and **patchy** atructures, is
~0.3 - 9.4. This value is also well within
the range of existing theoretical estimates,
iJovian megnetosphere, magnetic tail,
boundary layer, rotational discontinuity].

5755 Plasca Instabilities

1371 Plaza Instabilities are usually barkscatter and/or two choics, precipitation romes around the points that are magnetically conjugate to the sources are also estimated. The results presented can be used to interpret spitiation injuced by ground-based VLV transmitters.

J. ecophys. Pes., A. Paper 4.0121

3530 Wave propagation
MCCLATED SEAN INICITION OF SIX 3 WITH HE DE 1 STELLING
MACRIEC COMPUNCTIONS OF SIX 3 WITH HE DE 1 STELLING
LA SELVENING SEAN INICITION OF SIX 3 WITH HE DE 1 STELLING
Si. No. A. Selectron beam resisted from the specially designed very low frequency (VIF) lorants in an attempt to generate whistier wide saves. M.A. Instable operations of the selectron tentiated during times of macricelly designed very low frequency (VIF) lorants in an attempt to generate whistier wide saves. M.A. Instable operations of the uncomber with a very wask instable of the instable of the selectron tentiated during times of macricellange in the probabend VLF receivers. Coordinated FFEGMIF modulations and NC I without that the emitted divertions struck the main twice is such that the emitted divertions struck the main twice is such that the emitted divertions struck the main twice is such that the emitted divertions struck the main twice is such that the emitted divertions struck the main twice is such that the emitted divertions struck the main twice is such that the emitted alcertions struck the main twice is such that the emitted alcertions struck the main twice is such that the emitted alcertions struck the main twice is such that the emitted alcertions struck the main twice is propagate from the ST3 3 location of the composition process in the F very local structure of the propagate from the ST3 3 location of the composition process in the F very local structure of the propagate from the ST3 3 location to the composition process in the F very local structure of the propagate from the ST3 3 location to the composition process in the F very local structure of the propagate from the ST3 3 location to the compositi

J. Geophys. Rus., A. Paper (A011)

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5770 Short-paried (isse them I day) variations of man-

nia, 90026), R. L. McPhetran and T. Turesawa
Dependence of the power spectrum of Pt 3-4 magnetic
pulsarium observed at the ATS & gangeschronous satellits on the interplanetary magnetic field (INF) has been
studied. Pulsarium evenis that ware observed near coop
and switchind harounic utinuture are chosen for smalysis. We further entert pulsarium events with identical
fundamental frequency to study dependence of the power
of pulsarium at different harounic bands on the INF. A
weak negative correlation is observed between the INF
ross angle fig. and the power of pulsarium is the
frequency range 20-70 rds. Alam, a positive correlation
between the internative of the INF fingly and the power of
pulsariums at 10-70 rds is found. This type control is
present at all ranges of the come angle. We compare
this observation with the frequency of bow-shockassociated upstrom waves predicted from a model of twee
generation by a evolution resonance of ions reflected at
the how shock. The predicted frequency depends on the
INF as figured fig., Although this relation gives a
proportionality between the frequency and Appy qualitatively consistent with the observation, if does not
even the pulsariums. (Interplanetary magnetic field, magnatic pulsariums.) J. Octophys. Res., A, Paper 440036

5775 Parelies and Fluido-Highetosphoro INTENSE LOW THEOLY LOW POPULATIONS AT LOW EQUATORIAL ALTITUMES D. J. Williams IThe Johns Hopkins University, Applied D. J. Williams iThe Johns Beythine University, Applied Physics Laboratory, Juhns Beythins Ensid, Leurel, Maryland 20707), L. A. Frank The combined data from the ISEE-1 medium energy and plasma instruments have identified the existence of surprising spectral structures in the trapped ion population at the equatorial sixtudes, 2 £ £ 4 and a. 50°. By snalysing our instruments' responses at ago 50°. ng.

the limits of their cayshillities, we are able to
resolve a double peak structure just below the
lestruments' energy overlap region (20-40 keV). Two narrow $(\frac{\Delta E}{R} \sim 0.4)$ energy peaks are observed. We

narrow | $\frac{\Delta E}{E}$ ~ 0.41 energy peaks are observed. We conclude that the higher energy [HE] peak is eagle up of singly lonised tone | HE | No² , O²). At L ~ 1 the HE peak is located at ~ 17 toV and the LT peak at ~ 12 toV. The energy of the peaks increases as L decreases and the intensity of the peaks is ~ 2100° lone/or see star keV. Orbit geometry and available data recordings allowed those lone to be observed for the six month period November 1977 through April 1978 and over the local time range ~0300-1900 hours LT. These characteriaties plus charge evokange lifetizes possevere boundary conditions on possible source and injection mechanisms. Of those considered, lon cyclotrom acceleration of thermal tons in the presence of an anisotropic energetic population appears a likely source of these questioncerequity peaks. Additional peaks in the energetic ion spectra are observed at energies 2 40 keV. Home of this higher energy structure may be related to cross-1 diffusion of multi-component ion populations. J. Geophys. Bas., A. Paper 4A0000

5//5 Trapped Particles
Pitch Angle Miffusion in the Juvien Magnetodiso
T. J. Birmingham (Leboratory for Estraterrestrial
Physics, NASA/Godderd Space Flight Conter, Greenbell,
ND.

Official value and the properties of the propert

5799 Sodar Wind intermittions with Poon and Planets Formation And OTRATICS OF LANGE-BLAIL RANGED SPECTURES IN THE LONGSPHEEL OF VEHICLE re a. Flowing Cymer Physics and Astronom lopathemic, for Physicalty, P.C. Roy Phys. Rep. 197, 1802 177.251 b title paper, we cannine the formation and dynamics of large-monite cognities that much attraction must be the result of inconfessation of the construction of interplantary itself times into the lemopages, rather than remarks of large fields persisting for long periods without connection to the self-wind-induced current and runvection pattern. In particular, we demonstrate that the magnetic diffusion of such attractures sould result in their dissipation with the scales of 1-10 minutes, if they were not attend what attractures in connective and diffusive equilibrius. It is shown that the equations governing the diffusion of these magnetic structures are identical to those governing diffusion of a sea out of an enclosed chashes with a percus wall, and a simple analog is filtutrated. The application of a flower consists to magnetic fields of setrophysical planmas in discussed. (Young lonespiere, present) ustrophysical plansmas is discussed. (Youds tonos) Dagnetic diffusion: J. Goophys. Res., A. Paper 4A0098

Physical Properties of Rocks SILD Flow (Quartz Planticity) PLASTICITY AND HYDROLYTTC WEARRING OF QUARTZ SIRGLE

CRYSTALS
J. Bleeic (Geophysics Group, C335, Los Almos Metical Laboratory, Los Alamos, New Moxico, 87545), and J. Christie

Laboratory, Los Alamos, New Moxico, 27145), and J. Christie

Cuarit deforms by wilp on numerous planes, generally with Burgars vectors 1/J <7110s and (0001). Dry natural crystals deformed in an anhydrous saviroussation in the process of the control of the contr the Antarctic Research Series?

the Antarctic Research Series of the Antarctic Pressure of the A

6110 Elasticity, fracture, and flow EFFECTS OF COMPRESSION DIRECTION OF THE PLASTICITY AND REDOLOGY OF HYBOLYTICALLY VEAKENED SYSTHETIC QUARTZ CRYSTALS AT ATMOSPHERIC PRESSURS.

M. F. Linher (U.S. Ceological Burvey, 345 Middifield Road, Manlo Park, Galifornis, 98025), S. R. Kirby.

A. Ord, and J. M. Christie

A hydrothermally grown synthetic quarts crystel with 370 the dyps hydroxyl impurity was cut into right rectangular prisms in eight crystallographic orientations. We compressed the prisms under constant axial force corresponding to a miskfal stress of 140.0 the 3.5 Mp., and temperatures of 510 and 750°C.

All but one of the semples austained permanent axial strains of 2 to 3%. We established the operating stip systems from specimen shape change, sitp bands and dislocation atch pits on polished surfaces, crystallographic orientation changes, strass-optical festures in thin sections, and from transmission electron microscopy. The observed creep behavior and plasticity divided the samples into three groups: (1) Grystals compressed (1011) and (1011) deformed principally by stip parallal to [0001]. Creep rates were relatively high and were not strongly sensitive to test temperature. Dislocation arrays aproximately parallel to (210) are common. Dislocation loops are alonged parallel to [0001], indicating that the edge augments were more mobile than the acress augments. (2) The second group of samples were loaded normal to [0001] in three orientarions: [1100, [0100], and at 45° to (1100). These samples deformed primarity by [1010] at align with some systems. They were more creep resistant than the first group and displayed a such higher sensitivity of creep rate to test temperature. Dislocation there were motern obtained to a sensitivity of creep rate to test temperature. Dislocation there were observed. These results Confirm our serils were observed. The creep anisotropy for this sense crystal. The creep anisotropy parallels a remarkably sixtlar anisotropy in the diffusion and creep associated with hydrolytic wea

olio Elasticity, Fractura, and Flow Experiments. The Department of the Experimental Deportation of TupAZ Cystals: Published Natural Published National Published National Published Natural Na

Planetology

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1650 (interplanetary dist)

1650 (interplanet repairs varies with the flight direction of the nateo-rite. The size range and composition of trom-mickel spheres on the surface of Bjurbole are smaller to apheres collected in the stratosphere. A comparison of airthospheric dust collections with nateoritic surfaces may provide further insight into the machanisms of telegroid entry into planetary almospheres. (Bjurbole, abilation, stratospheric dust, MM) 1. Peophys. Res., B, Paper 185041

DEGASSING OF METEORITE PARENT SODIES

N. Suglura, N. S. Berr and D. V. Strangway
(Department of Geology, University of Toronto)

T. Marsol.

Gas Permashility of three chondrites was massured.

A typical time for degassing of a 100-km-radius
parent body was calculated based on these parmeability values. It was found that an ordinary chondrite parant body would act as an open system
during the neatmentphic period (100 m.y.), while an
ematatite chondrite perent body would act as a
closed system. The possibility that volatile
oleman concentrations in chondrites are controlled
by pareneblility is discussed.

J. Geology, Dec. Beaut. Beaut. 2000.

J. Geophys. Res., B. Paper 385009

6575 Surfaces of Planets VENUS: THE NATURE OF THE SURFACE FROM VENERA PANORAMAS J. B. Garyin (Dept. of Geological Sciences, Brown Univ. Providence, RI 02912), J. W. Head, M. T. Zuber, and P. Helfontania

S. Garyin (Dept. of Geological Sciences, Brown Univ. Providence, RI 03912), J. W. Head, M. T. Zuber, and P. Helfonstein
Images of the surface of Venus obtained by the Soviet Venera 9, 10, 13, and 14 landers have been analyzed to provide a beats for understanding the nature of geologic processes operating there. The four spacecraft landed in the Beta-Phaebe region at median elevations in the upland relling plains province. The landing points are each separated by distances of more than a thousand im. The Venera pandramas were digitized and transformed into various perspectives in order to fac-littate analysis and comparison with other planetary surfaces. Bedrock is exposed at the Venera [0, 13, and 14 siles and is characterized by semi-continuous, flat polygonal to subrounded patches up to several m in width. The bedrock surface is often dominated by subhorizontal to horizontal layared plates with thicknesses of several came and abundant linear and polygonal vertical fractures. Angular to subangular layered to platy blocks in the 5 to 70 cm range dominate the Venera 9 site and occur much loss frequently at the other sites. Blocks appear to share many characteristics with the exposed bedrock and are interpreted to be largely derived from it. Soils (particles ic.) are abundant at the Venera 9, 10, and 13 sites, but are uncornon at Yenera 14. Features indicative of a strong colian influence (mosts, dunes, wind tails) are not observed. A striling aspect of the Venera landing sites is being extreme similarity despite separation distances of thousands of im. Several hypotheses are considered for the origin of bedrock surfaces, and we investigate in datall like hypothesis that bedrock originated from surface layer lows. In this interpretation, the formation and deformation of a semi-soild crust. The layering is interpretation, the formation and horizontal sheets formed by cooling surface morphology is consistent with Venera 13 and 14 geothesical results which reported high potassical basing during cooling. This interpr

alt and tholeistic basalt compositions, respectively. If this interpretation is correct large regions of the Deta-Phoebe area are likely to be characterized by lava flows. The relative freshness of features observed by Vonera 14 suggests that some bedrock surfaces are geologically young, or that erosion rates are low. (Yonus, Vonera Reportshologically supports of the control of

Venera, quamorphology,

J. Heophys. Rus., B. Papar apol62

6575 Surface of planets (impoct mataborphism)

CHEMICAL AND STRUCTURAL CHARGES INDUCED BY THERMAL

ANMEALING OF SHOCKED PELBRAR INCLUSIONS IN IMPACT MELT

ROCKS FROM LAPPAJÄRVI CHATER, PINLARD

A. Bischoff (institut für Mineralogie, Corrensatzaße 22,

D-4400 Munster, S-Carmany) and D. Stoffier

Flaglociase and microcline of classic minoral and rock
inclusions in impact melt rocks (Marmaica) were sampled

from the coherent melt sheet located in the contral

crater area of the Lappajärvi meteorite crater and

analyzed by optical, electron optical, a-ray, and bicroproba methods. Both types of feldapara display atrong

chemical, textural, and structural alterations compared

to the feldapars of their parental crystalline basezent

rocks as a result of the thermal energy supplied by the

autrounding superbasted impact melt, increporation

into the molt results in increasing thormal alteration

by the mait. In a lower degree of shock both primary

plagloclase and microcline transform to "checkerboard"
textured grains which consists of 5-10 ps mixed subgrains

of succetically groun smidline and quarts. The subgrains

of succetically groun smidline and quarts. The subgrains

of succetically groun smidline and quarts. The subgrains

are strongly momed, disordered impressed. The sub
grains are the rosult of a non-equilibrium fractional

crystallization from a liquid state during which a

strong chemical eachange between the melt and the

feldapar inclusions took place. On the basis of codel

calculations it is concluded that the temperature of the

termilization temperature of the incorporation of the

classic debris was in the range of 1800 to 2100°C. The

equilibration temperatures of the hieroproporation of the

classic debris was in the range of the superiture is

astigated accordingly to be at least in the range of

100 to 1140°C or higher depending on the magnitude of

the class's post shock temperature. This temperature is

above the solidus and in p

J. Geophys. Rus., B. Paper 185124

Lapsjärvi crater, impet matamorphismi.

J. Geophys. Ras., B. Paper 185124

6575 Eurfane of Planets
A PROFORD OPIGIN FOR PALIMPRESTE AND ANOMALOUS PIT CRATESS ON GANYMEDE AND CALLISTO
S.K. Croft (Lunar & Planetary Laboratory, University of Arisons, Tucson Arisons 33721)
Pallapsests and sammalous pit craters are two classes of craters found on the leg satellites Canymade and Callisto which have no obvious constraparts among the crater populations found on rocky planets. The distinct characteristics of palimpsests and anomalous pit craters in morphology, morphomatry, and population statistics, which differentiate them from the more numerous "Anomalion protects and basins on the leg satellites, also wirtually preclude their origin as normal craters that have mearly variended impact structures formed when the flow of material during the modification stage of crater formation is dominated by "wet." Fluid flow as opposed to "dry" granular flow which forms normal craters; conditions of "wet: modification flow occur than the volume of mait remaining in the crater attains a volume comparable to the volume of the includes:

1) planeible impact modification flow occur than the volume of mait remaining in the crater attains a volume comparable to the volume of the includes:

1) planeible impact welcrity distributions, 2) crater scaling in ice. 31 shock selling in ice. 4: thermal profiles as a function of time in Ganymada, and 5) cratering flow field constraints, conditions for wat modification flow are found to occur for sufficiently large impacts or high-velocity impactors. The range of normal crater-palimpsent transition diameters and the surphologic characteristics inferred from the impact which have impact velocities mer the avorage of 15 km/s, anomalous pit craters (inferred to be transitional forms) from intermediate velocity impactors travelling in excess of about 40 km/s. The impactors travelling in excess of about 40 km/s. The impactors travelling in excess of about 40 km/s. The impactors travelling in excess of ab

Seismology

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6970 Structure of the Crust and Upper Mantle
A SEISMIC REFRACTION STUDY OF THE DEFINIT CASADES
D. S. Lvaver (Geophysics Program, University of ManiIngton, AK-50, Seattle, MA 98195), W. D. Myoner, and
W. M. Kohler
A 275 by long rovarsad refraction profile along the
axis of the Pregun Cascadre, augmented with earthquake
and gravity data, indicates high crustal velocities
(b. 1 to 7.0 km/s), thick crust (46 km), low Pn velurity
(7.7 km/s), and higher upper mantle velocities
(8.2 km/s at 100 km dosth). (8. km/s at 100 km depth). J. Geophys. Res., B. Paper 480179

Social Sciences

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ECOMPLY RESULTS OF SIGNATUR CRAMES IN PARTITION'S
PRINCIPLED ANTIFE

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University of Illicits, Orbons, Illicots, t1201), and

J. O. Peues
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A MORI. FOR CONSTRAINED OPTIMON WATER PRICING ARD
CAPACITY EXPANSION

G. C. Bendy (Department of Civil Engineering.
E. A. Mchem and B. G. Hutchinson
Freelous Atwise of optime water pricing and capacity
repension have ignored the political and administrative
repension have ignored the political and administrative
general modal in presented for identifying the vater
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hypothetical cased attudy of an other water supply system.
The testules indicate that optimus water supply system
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cost pricing. Administrative and political constraints
and to reduce these benefits but result in more
acceptable pricing politics. (Vator pricing, dynamic
programming, capacity expansion).

Mater Besour. Ros., Paper 44009) Mater Besour, Ros., Paper 440093

Solar Physics, Astrophysics, and Astronomy

ATMOSPHERIC CAPPAR ADDATION: A COMPARISON OF EXPERIMENTAL RESULTS AT 4.5 GV AND 11.7 CV J.H. Lavigua (CESE/CHES/UPS B.P. 4346 -31029 Toulouse

cades - France), M. Siel, Č. Vedranne, B. Agrinter

"Agathe", a joint G.E.A. (Saclay)-GER (Toulouse) espariment, is a spark observe for garma ray measure sets in
the L-C MeV energy range. It was used to measure the file
of atmospheric photons at 1--3" geographic latitude
frightly 11-7 GP) during two flights from Brazil, in the
course of a campaign organized by the Franch Spars Agency
(CMES). The results are compared to those obtained from
flights of the engineering model of Agathe and a model
for a time of flight appear, tested to evaluate improvaments for the Agathe appearing to 18 MeV;

- determination of the atmospheric gazma ray fluxes or
count rate as a function of pressure attitude I in these
energy ranges the downward atmospheric flux is proportional to Fa with a 1
- the determination of the atmospheric spectrum at 1
-3" in Brazil and at 1-40" in the morthern hemisphere:
in Brazil the downward atmospheric spectrum can be represented by by; = 2.4 10-3 T.-4 photons/cmls.s.m.MeV g/
cml in the 100 MeV energy range and 4 (g) = 2.1 10-2

F1-3 photons/cmls.s.m.fa flux is propor
- the determination of the proporation of the street of the fill of the contraction of the contractio

g-1.9 photons/cm2/s/ss/NeV g/cm2 for E:100 MeV energy range.

- the determination of the ratio between the fluxes measured in Brazil and in the Northern hemisphers : this ratio is 1.8 : 0.2

It has been shown that the fluxes of downward and upward roving gazzar rays are equal at a pressure of about 40 ob.

The dependance of the downward moving fluxes as a function of the pressure is different of that published by ling. But, if we sawar that attackplertic component is lostropic at 40 ob, the esperimental fluxes determined from the emperiments described here, eggen with the measured fluxes rise into account by Ling in these calculations for the 4-10 MeV energy range. (Keywords) game radiation - empspheric component). J. Geoghyn. Rem., A. Paper BAI958

Tectonophysics

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Sind Plate Tectonics

ROF BEAN SQUAKE VELOCITIES OF THE CONTINENTS WITE

RESPICT TO THE ROT SPOTS SINCE THE EARLY JURASSIC

Frederick R. Senuit (Department of Geophysics, Stanford University, Stanford, California, 81305) and Richard G. Gordon

The root mean square velocities of the major continents with respect to the hot spuis were estimated for the past 180 my, by combining pre-isously published pilate reconstructions. These velocities agree well with velocities relative to the apin axis inferred from paleomegachic data Fram ~180 my B P to ~146 my B P. the hot sput data indicate that Laurasia moved rapidly. ~70 mm/yr, but the reconstructions permit a wilcuty as low as 50 mm/yr, but the reconstructions permit a miscale along a low as 50 mm/yr. B P. inde moved rapidly (~1400 mm/yr), laster than the present velocity of any plate and more than twice as last as the procent velocities of several subducting oceanic pilates (those attached to downging slabs along a substantial fraction of their margin). The data require no other continent to have excueded a velocity of 40 mm/yr during the last 1800 my.

In agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement with previous studies based on paleomagnetic data and in agreement studies based on paleomag

Bim Plate Fectorics PROFACTION AND LINEAUE OF OLDANIC PIDEE SECURNS D. D. Pottard (U.S. Contorical Survey, 155 Middleffield Fort, Monior Park, CA. 540211, and

is miditariate break, Menin Park, CA, \$402-11, or 6. Autin.

We have investigated the propagation or spreading ridge and the development of all Clares that link ridge against using an arms, present ridge and eraces in claret plates. The singe-propagation for each in claret plates. The singe-propagation for each of a path factor time controls propagation for a world a path factor time controls propagation force increases in ridge went approach, but from the limes observed on the ends of the path action of the each of the controls propagation force increases in ridge went approach, but from the limes observed and park, or the exercise propagation and park, or the exercise propagation of the park of the park

Same of the major sectoric and magnetic events of the Sees of the day'r technical conditions can be correlated that 130 Ha in the Western Conditions of a carrelated with a new podel for the displacement histories between western North Acerica and adjacent occanic plates. with a naw model for the displace and histories between western North Accrica and adjacent occasic plates. Sterra Mewada platesica and adjacent occasic plates. Sterra Mewada platesical ended and Laranida cupression began during increasingly repul convergence of the Fazalion plate with Borth Accrica and during a moderate increase in the westward ration of North America in the houstput reference farms. The send of the Laranida and beginning of widespread are anguarted and retension currelaton with slowing of hoth of these totions. The spectacions slowing in Faralicon-Borth America convergance is attributed to the decreasing age of the Faralicon plate entering the translet and to a change from negative to positive buoyuncy. The transletion from widespread arc-related cugantism and rapid extension to be sentite volcanian and coderate estension in the Busin and Range province links on ready applanation in the plate polices of the Faralic basin. A change to oblique apreading in the Busin and Range province accompanied accompanied accompanied accompanied accompanied accompanied plate actions. March America Sault as the Kando-cino trapic junction progressed morthward. (Tectonics, plate notions, Paper 191886

8150 Tectorophysics (Plats tectorics) On the Stability of IRIPLE DUCTIONS

AND ITS FILATINI OF INTITE JOHN AND ITS FILATING AND ITS FILATINI OF PERSONNELLY IN SPREADING PRINTING IN Globe de Perin and Unité d'Impelgement et de Recherche des Sciences Physique de la larre, Universités Parin 677, Paris!

and Unité d'Enseignement et de Machescheins Sciences Physiques de la isrre, Universités Paris 677, Parisi

A convenient representation of triple junctions that involve only ridges (8) and transfore finite (f) is proposed this representation combines in a simple say information from quographic and valurity spaces. The valurity triangle provides the budget of lithespheric nurface change which directly results from interections of the triple junction af the three politices of the triple junction with respect to the volocity triangle demonstrates that, in general, there are several triple junction configurations that are cognition with a given triangle, this discussion of triple junction configurations of the triple junction configurations of children of children internal are HON-RRI and RRH-FIR. When the triple junction that are all particular internal are HON-RRI and RRH-FIR. When the triple junction is notated to the triple junction configuration is of the ridge will shouten, londing to set smaller type of potentially settlem configuration. The provision of the triple junction of the triple junction of the triple junction of the standing to the part of the light of the settlem of the light of the light of the settle

Volcanology

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Responded the development of succinates that line rings angle and the development of succinates that line rings angle and the development of succinates that line rings angle and a path factor that controls propagation for a made a path factor that controls propagation for and a path factor that controls propagation for the succinate for whelm stage agreeds propagating toward cash other 16 rings propagation for the responsibility of the success as the mond factor that controls propagation are repetationed in the rings propagation for the responsibility of the path of the rings propagation for the responsibility of the responsibilit 8699 Volcanology E-pich EREPTION PATES AND CHEMISTERMAL INVEST AT INS MOMENTS